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China Report

SCIENCE AND TECHNOLOGY

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11 June 1985

CHINA REPORT
SCIENCE AND TECHNOLOGY

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NATIONAL DEVELOPMENTS

CHEN LEI'S REPORT ON SCIENTIFIC, TECHNICAL REFORM

SK100123 Harbin Heilongjiang Provincial Service in Mandarin 1000 GMT 8 May 85

[Excerpts] In his report to the provincial scientific and technological work conference on 8 May, Governor Chen Lei set forth our province's major tasks and basic requirements for a scientific and technological restructure. The provincial scientific and technological work conference was sponsored with a view to implementing the CPC Central Committee's decision on the reform of the scientific and technological structure.

Governor Chen Lei urged: We should conscientiously introduce the objective economic law and market functions reflected by the socialist commodity economy to the fields of scientific and technological development and management and inject new vitality into our province's scientific and technological undertakings in order to make science and technology better serve the economic construction and to promote a coordinated development of science and technology, economy, and society.

He said: We should attach importance to the reform of the following items.

1. We should reform the planning and expense management systems and carry out a technological contract system.
2. We should accelerate the commercialization of the technological achievements and vigorously open technological markets.
3. We should achieve lateral cooperations and strengthen the enterprises' ability in absorbing and developing technology.
4. We should expand the decision-making power of scientific research units and comprehensively carry out a system of unit chiefs taking the whole responsibility.
5. We should reform the agricultural scientific and technological system in order to meet the demands of the rural production structure.
6. We should reform the scientific and technological cadres' management system and carry out into full play the functions of scientific and technological personnel.

Governor Chen Lei said: Only by opening technological markets and promoting technological transfer can we turn science and technology into practical productive forces. It is a problem that needs an urgent solution at present. This year, we should concentrate the scientific and technological reform on running good technological markets and commercializing technological achievements. While firmly attending to running the province's technological markets, all cities and counties should enthusiastically create conditions, substantiate strength, and augment the equipment to gradually develop technological markets and to form an unimpeded technological trade network.

Governor Chen Lei pointed out: The research units and universities and colleges engaged in technological development should readjust their focal points of research work in accordance with the principle of gearing to the economic construction, and establish various forms of cooperation ties with production departments in line with the principle of voluntary participation and mutual benefits in order to make themselves become an important force in helping enterprises develop new products and new technology. While fully relying on the social scientific and technological forces, the enterprises should enrich and strengthen their ability in technological development. The large and medium-sized key enterprises with strong technological capacity and small and medium-sized enterprises with favorable conditions should concentrate certain production capacity and certain technological force on developing new technology and set up and improve the technological development departments to gradually promote the enterprises' production, management, and development.

CSO: 4008/336

NATIONAL DEVELOPMENTS

LI LIAN SPEAKS AT SCIENTIFIC MEETING

SK120456 Harbin Heilongjiang Provincial Service in Mandarin 1000 GMT 10 May 85

[Text] The provincial work conference on science and technology held in Harbin City concluded today. Li Lian, secretary of the provincial CPC Committee, delivered a speech at today's session. He stated: The key to making the province's economy prosperous and fulfilling the general target and task of quadrupling annual industrial and agricultural output value lies in knowledge and talented people. Leading cadres at all levels should set themselves as examples in respecting knowledge and talented people and should create a fine social morale in which knowledge and talented people are respected by all.

Li Lian stated: Our province has more than 524,000 specialized personnel in science and technology at present. Of these personnel, 280,000 are specialized in the natural sciences. This is the tremendous wealth of the province, wherein lies the province's hope in achieving a leap forward in the economy.

In referring to the issue of how to respect knowledge and talented people, Li Lian pointed out: At present, we should do a good job in grasping the following three tasks: 1) A good job should be done in grasping the work of conducting scientific research and the popularization and application of scientific and technological results which serve the task of overcoming knotty difficulties cropping up in production and economic construction. 2) Efforts should be made to create a suitable environment in which talented people can display their abilities. 3) Efforts should be made to know talented people well enough and to assign them jobs commensurate with their abilities.

Li Lian stated: Our policy should encourage talented people to utilize their talent and should oppose obliterating people's talent. It should make it possible for various talented people to utilize their abilities. However, we should well understand that respecting knowledge and talented people does not mean arranging higher positions for talented people. We should impose heavy tasks on talented people. To successfully deal with the question of respecting knowledge and talented people, it is imperative to do away with the practice of demanding perfection, promoting personnel only in line with their seniority, and employing personnel only according to whether they attain perfect scores on an examination. As a matter of fact, talented people cannot be good in all fields. School diplomas cannot mean equal abilities among personnel.

Li Lian stressed: Leading cadres at all levels should set themselves as examples in respecting knowledge and talented people and should exert an influence or guide cadres and the masses as a whole to foster a fine social morale in which knowledge and talented people are respected by all. He urged leading cadres at all levels to resolutely fulfill the following four tasks:

1. It is imperative to discern the extreme importance of respecting knowledge and talented people from the high plane of economic strategy. Leading cadres should be leaders who are sufficiently sober and ambitious so that they refrain from paying attention only to current production tasks and economic targets while neglecting achieving development in intellectual resources and investing in intellectual ability. They should also firmly remember their responsibility in this regard at all times.
2. It is necessary to foster the Marxist viewpoint regarding talented people. To be mature leaders, it is imperative for leading cadres to have the vision to seek talented people, the far-reaching idea to create a reserve of talented people, the methods to train talented people, the ways to employ talented people, the courage to protect talented people, and the broad-mindedness to tolerate different views of talented people.
3. Efforts should be made to show concern for and cherish intellectuals politically. At present, attention should be paid to dealing with the difficulties hindering intellectuals in applying for party membership. Efforts should be made to eliminate leftist influence and overcome prejudice against intellectuals in order to recruit, in a timely manner, outstanding intellectuals whose conditions meet entrance into the party.
3. Efforts should be made to deal realistically with the problems encountered by intellectuals. We should respect and trust them in the field of politics and ideology. Attention should be paid to improving their livelihood and working conditions. In line with the principle of distribution according to work, we should give great awards to the intellectuals who have made marked contributions. By no means should we refrain from giving awards to those who deserve to be commended on the pretext of blocking the malpractice of giving bonuses arbitrarily.

CSO: 4008/336

NATIONAL DEVELOPMENTS

REFORM OF SCIENTIFIC RESEARCH MANAGEMENT

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 3, 1984 pp 32-38

[Article from the Office of the Science Foundation Committee of the Chinese Academy of Sciences: "An Effective Experiment on the Reform of Scientific Research Management--A Report of the Working Situation of the Science Foundation"]

[Text] In accordance with the suggestion of 89 committee members in the fourth committee meeting of Academic Departments of the Chinese Academy of Sciences, the State Council approved the formation of the Science Foundation of the Chinese Academy of Sciences in 1982. Thus, our Academy set up a Science Foundation Committee and its administrative body with comrade Lu Jiaxi [4151 0857 6932] as director, comrades Yan Dongsheng [0917 2639 3932] and Xie Xide [6200 1585 1795] as vice directors and worked out "the Practice Rules of the Proposed Regulations of the Science Foundation." Every Academic Department set up its Science Foundation Group equipped with full time or part time staff members. In 2 years, due to the vigorous support of the scientific community and the joint efforts of all the Academic Departments, engaging and organizing and business construction, while at the same time carrying out tasks such as accepting applications, evaluations and managing, we have made encouraging progress and obtained great enthusiasm and attention from the broad masses of scientific and technical personnel and the departments concerned.

I

The Science Foundation is a new investment in the scientific undertakings of our country. Its target is the whole country and financially it supports mainly basic research in natural science and the basic tasks of practical research. In searching for a reforming path in the evaluation and management of projects and funds, we choose the basic practice as follows:

Free Organizing and Direct Application. The scientific and technical person who wants to apply to the Science Foundation, may submit the application directly to the Science Foundation, after weighing the need of his research work, freely forming his research group under a leader, filling out the application form of the Science Foundation and having passed the examination, screening and weighing from the unit leader and the academic committee.

Evaluation by Experts, Supporting High Quality Projects. The Science Foundation Committee and the Science Foundation Group in each Academic Department are the evaluating organizations formed from the committee members of the Academic Departments inside or outside the Academy. The Science Foundation Group in each Academic Department is in charge of examining and approving single proposals with funding under 10,000 yuan, submitting the evaluated opinion of projects that require more than 10,000 yuan and reporting them to the Science Foundation Committee for examination and approval. Usually, before a proposal is submitted to the Science Foundation Group for examination and approval, it needs a written appraisal from five experts in the same field. Sometimes, it needs an appraisal from a group meeting in a related field, in some academic department. The approval of a proposal to be funded, should follow the leading thought of economic construction, and the scope and principle of funding in "the Practicing Rules of the Proposed Regulations of the Science Foundation" and select the research proposal lacking science funding and possessing the conditions listed below:

1. With important significance in the national economic construction and scientific and technological development.
2. With original ideas, sufficient theoretical basis and a research technical operation that is clear and workable.
3. Not repeating a research work that another unit in the country is pursuing but being original.
4. A research work with a definite foundation and relative amount of research strength.
5. With clear research targets, reliable working procedures and a definite result obtainable within 3 to 5 years.

Applicant Shouldering the Responsibility, its Unit Supervising and Guaranteeing His Work. Once the subject and the amount of the funding is determined, they will be sent directly to the applicant and his working unit. The applicant takes total responsibility for the completion of the research task; and his working unit is responsible for supervision and examination and guarantees him proper working conditions. Under the unifying management of the unit, the applicant enjoys the rights of selecting members of his research group, drawing up the research plan, directing the research work, budgeting the fund according to the financial system requirements of the Science Foundation and the related benefits from the result of the scientific research.

Regular Check-up and Instant Feedback. The progress of funded research work and the budgeting of the funds should be both checked by the concerned personnel in the organization of the Academic Department and the Science Foundation and follow the following regulations: 1. The person responsible for the funded project and his unit should examine and summarize the work regularly, and submit a formal written report once every half year. 2. The grant is examined and approved once, but the fund is payed out in installments according to the progress of the research work. Through the examination of the "Application for Payment",

one can understand the development of the research work during the last period and the plans for the next period. 3. Upon the completion of the funded research work, one must seriously make a conclusion, an appraisal (or an evaluation), draw up the final financial account of expenditures and report related documents and materials to the Science Foundation Committee and concerned Academic Department. As to those fabricating results, not following the regulations of the Science Foundation or unable to complete the responsible duty without any reason, their payment will be interrupted or their grant will be cancelled.

From January 1982, when the Science Foundation began to accept applications, to the end of 1983, it obtained 3,038 research proposals for funding. After the first screening, it accepted 2,784 of them for further evaluation, with a total applied amount of 2,746,140,000 yuan. It has finished the evaluation of 2,562 proposals, with an applied amount of 245,650,000 yuan. The result of the evaluation is: in 1982, it approved the funding of 504 research projects, with total financial aid 28.3 million yuan; in 1983, it approved the funding of 949 research projects, with total financial aid 41.12 million yuan; total approved projects in 2 years were 1,453, with total financial aid of 69.42 million yuan. In addition to these, the Biology Department obtained funding for small projects, with 392 projects and 1,900,000 yuan.

The evaluation and approval task of the Science Foundation carries out the party's scientific and technological policy and based on the characteristics of each field, tries its best facing the economic construction requirements. Among the proposals that were approved, practical research weighs 73 percent (mainly basic practical research) in 1982, and 89 percent in 1983. They also reflected the principle of even distribution in the whole country. The approved projects in 1982 and 1983 were distributed among 24 Departments of national level and 235 units that belong to 25 provinces, municipalities and autonomous regions. As to the funding distribution, the institutes of higher learning directly run by the Ministry of Education obtained 50.2 percent, units belonging to Departments of Industry, Communication, Agriculture, Medicine and Defense obtained 26.7 percent, units belong to local divisions obtained 12.5 percent, the research institutes of the Chinese Academy of Sciences obtained 7.6 percent and the remainder of 3 percent belongs to the items of extensive cooperation in the whole country. In the process of evaluation and approval, the scientific and technical workers of middle age or in outlying district were given special support during the evaluation. When competing with other candidates with similar conditions, they will be considered a top priority. In 1983, the test set-up of small grants in the Biology Department, was an experiment in supporting middle aged scientific and technical personnel.

II

Although the Science Foundation was just set up, and with not much funds, after experimenting for 2 years, it has already shown its vitality.

1. It helps with discovery of scientific potential, makes up for the insufficiency of national scientific research planning, strongly supports the scientific research task and education task of institutes of higher learning.

Scientific research is a task with an exploration quality, many new ideas and new developments at the budding stage or some basic research tasks usually are difficult to be included in the national plan or appreciated by the consumers. This problem is especially conspicuous in the institutes of higher learning. They process a relatively high leveled basic research force, yet with severely insufficient and unsteady funds. Many meaningful research projects are in the situation of wanting to work but with no money yet with no heart to stop. Some projects are able to obtain some financial support in the stage of solving production and technical problems, but if they want to further study the mechanism and search for the rules that can be applied and extended to larger scope, no funds usually will be available. The establishment of the Science Foundation makes the experts with academic attainments able to improve their research conditions, the preponderance of some scientific teaching units will be given their full play, a number of research projects with significant meaning, with working base and strength, and some new ideas and new suggestions receive support and it taps steady and reliable financial sources for basic research and the theoretical work of the practical research. It plays an active role in exploring our scientific potential, especially the research potential of our institutes of higher learning.

The establishment of the Science Foundation also promotes the education of science and technology. First, improving the quality of higher education depends on the strengthening of basic research. Second, the participation of graduate students in the projects with financial support, greatly improves their educational level. There are 429 Ph.D. and masters degree candidates participating in the research projects approved for funding in 1983. Furthermore, the Science Foundation pays attention to the support of research works of middle-aged scientific and technical personnel, and help their growth. Among the projects approved for financial support in 1983, 67 percent of them are headed by middle aged scientific and technical workers.

2. It helps to arouse the enthusiasm and initiative of the scientific research personnel, improves the efficiency and quality of research work.

From choosing the subjects of research work, selecting research groups for the project, filling out the application forms, formulating and carrying out the research plan to use the research funds, the Science Foundation pays special attention to the strengthening of the responsibility of applicants, increasing the freedom in selecting projects and combines these with the supervision and assurance from their working units, thus helps to arouse the enthusiasm and initiative of the scientific research personnel. Besides, the selection of funding proposals is based on the principle of optimization, through the appraisal of the experts of the same field, it gives a good inspiration and promotional effect on the scientific research personnel and the recipients feel honored and with great responsibility. The scientific research personnel look at the awarded grants not only as material support but an academic honor. They feel the drive inside and the pressure outside. They are worried that if they can not obtain respectable results, they will lose reputation amongst their peers, and influence the chances of receiving continuous support from the Science Foundation. The working unit of the applicant also uses the number of projects being granted financial support from the Science Foundation and whether the

research results can be obtained on time as a symbol of the unit's academic level and its reputation in society, thus it pays more attention on the competing efforts of aquiring grants and the organizing and carrying out the approved projects. Some units organized a critique before submit their applications. After receiving notice of the approval of grants, some units had meetings and mobilized their workers, asking the grant holders their requests and opinions about the unit, and carried out specific steps for them. Some units proposed a slogan of "preserve reputation, hand out results" and encourage scientific research personnel to work hard and finish their duty with outstanding results. Those situations show the active effect of the Science Foundation on promoting competition, raising the effeciency and quality of research work and speeding up the rate of result production and educating able people.

According to the semiannual reports of early half of 1983 from the responsible people who received grants in 1982, and the investigation and understanding of the Science Foundation Committee and every Academic Department, the arrangement, implimentation and managing situation of the projects that received funding from the Science Fundation are very good, and their progress in research work are also relatively fast. Up to June 1983, there were 229 papers or research task reports from 122 projects. Some projects obtained certain stages of result. After the appraisal of the upper level deparments responsible for the work, they are being issued for practical use. The unit of the grant receiver also pays special attention to the management of the projects with grants. Usually it puts these projects in the category of major duty, files them according to their projects, inspects them regularly, trys its best to ensure the condition of their needs in testing, calculation, instruments and processing; and financially they have their own book-keeping, and their own special fund.

3. It helps the improvement of the distribution and management of scientific research funds, to overcome the drawback of equalitarianism and "eating out of the same big pot"

The Science Foundation does not use the method of every-level-take-its-share to distribute the funds. But on the basis of selecting quality projects, it distributes its funds according to individual projects and depending on the progress of each research project, it pays them in installments. By this method, it helps to overcome the drawback of equalitarianism and "eating out of the same big pot." to use the limited amount of funds more efficiently and reasonably. The funds are used mainly to support the research projects that have important meaning, can produce results and really need funding. At the same time, it also helps the inspection and supervision of spending situation of the funds and raises the spending efficiency of the funds.

4. It helps to break the system of departmental ownership, and promote the cooperative research

Projects supported by the Science Foundation can leap over the boundary of office, department, institute, university even ministry and region to organize a project group, and the use of its funding is not restricted by "eating in the mess of his unit." This gives a positive effect on the promotion of cooperative research, improvement of the transfer of knowledge, the interchange and

infiltration of academic ideas and development of frontier science. For example, the research and compiling of the records of our animals, our plants and our cryptograms and the one millionths tables of our earth resources, our land usage, types of our land, appearances of our land, the categories and resources of our grassland, our soil and the category of vegetation are all big cooperative works involving tens of units and more than a hundred people. Because of the lack of assurance of financial sources, these research and compiling tasks were on the verge of a standstill. After receiving the grant from the Science Foundation in 1982, they revised their plan, and increased their working pace. For another example, there were 15 units in 1982 and 1983 who applied for grants for the research on control systems and computer supplementary design. Their contents were disperse and duplicating one another and their machine connections and languages were not unified. The Automation Branch of the Technical Science Department organized the units of these applicants, formed a unified design group, set up an overall plan and centered on the common target, shared out the work and cooperated with one another. They expected to build a processing warehouse with a higher level, better usability, more complete functions and ease of use, thus accelerate the application of automation scientific technology.

5. It provides a better form for inquiry and directing the academic development and policy making about the scientific research for the committee members of the Academic Departments and the experts.

The Science Foundation set up conditions of its systems and its organizations for the committee members of academic departments and experts who participate in the policy management of scientific research. Thus, they can use their expertise and experiences to grasp the direction of funding of the Science Foundation, select the projects to be supported, evaluate the research plans, and appraise the research work of some projects. This practice has been deeply welcome and supported by the committee members of academic departments and other scientists. In 1982 and 1983, the total number of experts and scholars participating the task of evaluating the Science Foundation application projects is 12,500. The ratio of mail returned on evaluations is as high as 88 percent. This had a great effect on the completion of the arduous appraisal task, and the quality of those appraisals are improved. The establishment of the Science Foundation also enriched the works of the committee members of the academic departments, increased mutual understanding and connection among the Chinese Academy of Sciences and other departments on scientific and technical fronts. At the same time, it made the committee members outside the Academy and other scientific and technical workers more concerned about the work of the Academy.

From the experience of the past 2 years, it has been shown that the establishment of the Science Foundation which was suggested by the committee members of the academic departments and approved by the State Council was a farsighted move. It reflected the wishes of vast numbers of scientific and technical workers and complied with the needs for reform. At the same time, it was also shown that the basic practice of the Science Foundation and the tasks it developed was effective. But, since it has not been in existence long, there are still many problems to be solved. For example, the task of drawing up the guide for selecting projects of the Science Foundation does not move fast enough; the

methods and standards for evaluating the applied proposals of different departments and different fields are not unified; the problem of how to bring the effect of evaluation of the managing personnel into full play is still to be solved; management for funding the projects needs improvement, the practical experiences of how to bring the effect of experts into full play in management is still not sufficient and the administrative body of the Science Foundation is not perfect. From now on, starting from this basis, we should take further steps to improve and raise the level of our work, to make greater contributions to the undertaking of our scientific development.

Appendix: The Practicing Rules of the Proposed Regulations of the Science Foundation of the Chinese Academy of Science
(Revised in Oct 1982, in the second meeting of the Science Foundation Committee of the Chinese Academy of Sciences)

Based on the rules in the "The Practicing Rules of the Proposed Rules of the Science Foundation of the Chinese Academy of Sciences" and the experiences from the work of the Science Foundation in 1982, these rules were revised.

The Scope and Principle of Funding

[Article] I. The Science Foundation is mainly used to support financially basic research in natural science and the basic work in practical research in the whole country. It selects and supports the good research projects that qualify under the following conditions:

1. With important scientific value and practical meaning, especially ones that link with the need of modernization and socialist construction;
2. With original ideas, sufficient theoretical base and a research technical operation that is workable;
3. The content, the method and the technique applied in the proposed research should not repeat research work that other units in the country are pursuing. The work should be original;
4. A research work with definite foundation and with a research strength that can be developed in depth;
5. With a clear research target, reliable working procedures and a definite result obtainable within 3 to 5 years.

[Article] II. Except for the projects that belong to the big cooperative category, applicants for the Science Foundation should all submit their projects. The content of the research project should not be too broad, and its time limit should not be too long.

[Article] III. To help the development of discovery and education of able people and the improvement of the scientific undertaking of outlying regions, when competing with other candidates with similar conditions, the applications of the scientific and technical workers of middle age and outlying regions will

be considered a top priority. At the same time, the inter-departmental, inter-regional and inter-unit corporative projects among scientific and technical workers are encouraged. It can fully explore our scientific and technical potential and serve our national economic and defense construction in a better way.

[Article] IV. Under the premise of a guarantee of national scientific research and teaching planning, the application for the Science Foundation must explore the achievement potential. The researcher cannot engage in more than two major research projects at the same time. The other research duties of the applicant and his coworkers should be clearly indicated on the application form.

Application, Evaluation and Approval

[Article] V. The Science Foundation adopts a policy of accepting applications any time and examining on a set date. Usually the evaluation and approval are done once a year. The deadline for the end of year primary evaluation for the application is 31 May.¹

[Article] VI. Applicant for the Science Foundation must submit the "Application Form of the Science Foundation of the Chinese Academy of Sciences." The leader of the unit or the academic organization of the applicant should, according to the requirement of the Practising Rules of the Proposed Regulations of the Science Foundation, carefully proceed with examining, screening and balancing, making suggestions on areas such as the necessity of applying, the authenticity of the content of the application for,, the probability of achieving the research plan, whether the grant budget is reasonable and whether the unit can guarantee its basic working conditions, then sends the application form to the Science Foundation Committee of the Chinese Academy of Sciences (the Science Foundation for short). The application form should be written on 16 blank paper, sent in 15 copies and will not be returned whether it is accepted or not.

[Article] VII. The applicants to the Science Foundation must have titles of Associate Professor or higher or be a scientific and technical personnel with title equivalent to Associate Professor or higher. Other applicants have to be recommended by two well known professors or by scientific and technical personnel in the field with titles equivalent to professor. Applicants of out-lying regions, if they indeed can not find people with professional titles to recommend them, should explain the reason and situation and ask the scientific and technical personnel with titles of Associate Professor or higher level personnel in the department responsible for his work or local science committee members to recommend him.²

[Article] VIII. The applicant to the Science Foundation should be the person that is really in charge of the research project and not a nominal personnel that does not participate in the research work.

[Article] IX. The Science Foundation Application Forms are uniformly received and evaluated by the Science Foundation Office. After the initial acceptance, they will be sent to the Science Foundation Group of their

corresponding Academic Department. Then high level scientific and technical personnel in our country and abroad familiar with the performance of this subject and who have certain achievements in the academic world will be invited to proceed in an evaluation and discussion. For applied projects, if appropriate high level scientific and technical personnel to do the evaluation can not be found, then scientific and technical workers working in the forefront of scientific research, having certain academic levels and familiar with the subject may be invited to participate in the evaluation.

[Article] X. On the basis of appraising through discussion in the same field, the Science Foundation Group of each Academic Department evaluates the applied projects and is responsible for the approval of research grants of 100,000 yuan and below. Then it reports the approved and not approved projects to the Science Foundation for the record. If the Science Foundation has different opinions about a recorded project, it can propose a reconsideration of this case and change the decision made by the Science Foundation Group of the Academic Department. As to a single project applying for a grant that exceeds 100,000 yuan, the Science Foundation Group of each Academic Department will submit its evaluation opinion and reports to the Science Foundation for approval.

[Article] XI. The results of the evaluation and approval of the applied project for the Science Foundation will be formally transmitted to the applicant and his unit from the Science Foundation Office. The persons who participated in the evaluation, may not expose the opinions (including his own) expressed by each person in the discussion process and the research technical plan of the applicant to others.

Funds

[Article] XII. The research fund of the project supported by the Science Foundation is ratified once and paid in installments based on the progress of each research work. The surplus of the funds at the end of each year may be transferred for the next year's use.

[Article] XIII. Within 1 month after receiving the notification of grant approval, the applicant of the Science Foundation should draw up and submit a research work plan and an application form for accepting the grant, based on the amount of funds approved, the number of years set for this research and the opinions from the evaluation. After those are examined and verified by the related academic department and the Science Foundation Office, the fund will be sent out. If in special situations, the grant receiver can not submit his research work plan and application form for accepting grants in the specified time limit, he should submit a written explanation, otherwise, he will be considered to have given up the grant automatically.

[Article] XIV. The approved supporting fund is allocated to the unit of the person responsible for the research project and is managed and supervised by the financial department of the unit which he belongs to. It has its individual book keeping and accounting. The specific fund is only for a specific project. Within the scope of the rules of our financial system, the person responsible for the research project has the right to use and control the fund based on the research work plan.

[Article] XV. The application and spending of the supporting funds should be carefully calculated. One should practice strict economy and make full use of instruments, equipment and other material of his unit and cooperative units. The spending range is limited to the items that are directly needed in the project, such as, the instruments, experimental materials, fuel and power and reequipping the laboratory and the expense of necessary business trips, inspection and purchase of materials. The fund may not be used for land and construction, wages, supplementary wages, bonuses, labour insurance welfare fund, international activity funds such as inspection abroad, general instruments, purchasing funds for single instruments worth more than 50,000 yuan (if there is a special need, one should explain in detail, in case of investigation), and funds for enlarging and renovating the laboratory. Other expenses and equipment bought or ordered before the approved grant may not be included. As to imported instruments, one must submit an explanation of foreign exchange source, operating condition and a guarantee, to be included. An instrument, if it can be shared with two projects in the same unit may not be purchased twice.

[Article] XVI. The managing fee collected by the unit which the person responsible to the funding project belongs to should not exceed 5 percent of the expense of the project or exceed yuan from each project.

[Article] XVII. The budget of a grant should be compiled into an accounting report each fiscal year and sent to the Science Foundation Office before 20 January of the next year. After completion of the research work, a final account should be compiled within 2 months and submitted to the Science Foundation Office to be cancelled after verification. The surplus funds may be used generally as research funds in the grant receiver's unit and the research work directed by the person responsible for the Science Foundation grant has a priority (generally no less than 50 percent) to use it. If the amount of the surplus is considerable, the Science Foundation has the right to retrieve a certain amount of it and use it to support other projects.

Equipment

[Article] XVIII. The equipment needed in the funded project should be applied and settled according to the subordinating system by the unit which the person responsible to the project belongs to. It should establish an individual account for the equipment, based on a material managing system, to strengthen the management.

[Article] XIX. After the completion of the research work, the person responsible for the funded project should compile a registered report of the fixed assets and left-over equipment (the serial numbers, specifications, character index, manufacturer, purchase price and condition of each item) to the Science Foundation Office. Among them, the general equipment is free of charge and is turned over to the unit he belongs to; instrument with value of 10,000 and above is temporarily kept and used by his unit but according to need, the Science Foundation Office has the right to send it out to support other research projects. The unit sending out the instrument is responsible for the packing and shipping and should bill the expense to the unit receiving the equipment. If one's funded project is stopped or withdrawn for some reason, he should return the total left over funds and the income from the equipment to the Science Foundation.

Supervising and Inspection

[Article] XX. The unit which the person responsible for the funded project belongs to should include the project into the research work plan of the unit and strengthen its leadership and supervision. It should give the project vigorous support in conditions such as, time, man power and material, and instruct the close cooperation from business and administrative departments. When the unit assesses the work load and work results of its scientific research and teaching personnel, the time used in the research work of the Science Foundation project and the results should be included.

[Article] XXI. The person responsible for the funded project should submit a work report to the Science Foundation at regular intervals. He should submit a report of research plan progress at the end of each June, and submit an annual work conclusion and work arrangement plan for next stage at the end of every December. The use of the funds and the conditions of equipment purchasing and the written comments from his unit should all be included in each report. Papers and reports published during the same period should be in the appendix of the report. Those who do not submit reports without any explanation will not receive further funding.

[Article] XXII. If the applicant to the Science Foundation is transferred to another unit, moves abroad, has sick leave for more than a year or died in the process of project evaluation or in the middle of his research work of the funded project, the applicant or his unit should adopt a measure to ensure the research work proceed according to the plan. He or his unit should also report the need for replenishment and adjustment of the research force and the work arrangement to the Science Foundation and the Science Foundation Group of his related Academic Department for the record. If it involves a major change in the research plan, he or his unit should report it to the original approval unit for reevaluation.

[Article] XXIII. The Science Foundation compiles the funded projects into books regularly and sends them to concerned departments, committees and bureaus of the State Council and the science committee and education bureau of each province, municipality and autonomous region for assisting in supervision and examination. At the same time, they are used as a reference for the new applications to avoid repetition.

[Article] XXIV. The Science Foundation and the Science Foundation Group of each Academic Department adopt many devices and organizations, experts and concerned working personnel to inspect the research progress of the funded projects and of their spending, to make conclusions from the experience and to improve the work. If they discover any situations such as improper funding, a project already receiving enough funding through other channels and research work that is not worth continuing, they will stop the funding. As to those who forge results or graft and divert the funds, their grant will be withdrawn and in severe cases, an investigation of the responsible personnel and concerned units will be pursued and they will be dealt with sternly.

[Article] XXV. After the completion of the research work of a funded project, one should seriously proceed with a summary. He should sort out complete data

tables and references, write a research report, an academic paper and a work summary, and after receiving the comments from his unit, report them to the Science Foundation and the Science Foundation Group in the concerned Academic Department. The paper or data that reflects the research result should clearly indicate that it is supported by a grant from the Science Foundation of the Chinese Academy of Sciences.

[Article] XXVI. The research results of funded projects should be criticized and appraised by their units and reported to the Science Foundation, the Science Foundation Group of the concerned Academic Department and higher level department responsible for the work. The Science Foundation and the Science Foundation Group of the Academic Department then select the results with important meaning, further criticize and appraise them, compile the results with significant academic meaning or practical value and recommend them to the concerned departments.

[Article] XXVII. The patent application, award and transfer of the results of the funded project should be conducted according to our related rules.

Others

[Article] XXVIII. The Science Foundation application forms and these rules are distributed to the concerned departments, committees and bureaus of the State Council and the science committee and education bureau of every province, municipality and autonomous region, the science committee of every provincial city, key institutes of higher learning and the branch academies of the Chinese Academy of Sciences. Applicants of every research unit may ask for or examine them locally.

[Article] XXIX. These modified rules come into force upon promulgation and the "Practicing Rules of the Proposed Regulations of the Science Foundation of the Chinese Academy of Sciences" drawn up on 2 March 1982 are abolished at the same time.

Footnotes

1. Changed to 31 March since 1984.
2. Middle level scientific and technical personnel applying for Science Foundation, may be recommended by two associate professor leveled scientific and technical personnel of the same field.

12875
CSO: 4008/6

NATIONAL DEVELOPMENTS

JOINT VENTURE OPENS TO TRAIN CHINESE TECHNICIANS, ENGINEERS

HK050517 Beijing CHINA DAILY in English 5 May 85 p 2

[By CHINA DAILY staff reporter]

[Text] Beijing Bailey Technical Centre opened yesterday in Beijing to the cheers of more than 200 foreign and Chinese guests.

The centre will be used to train Chinese technicians, engineers and students in advanced automation and process control technology.

The centre is only the first step of a new joint venture between Beijing Instrument Industry Corporation and the Ohio-based Bailey Controls Company of the United States, said M. A. Keyes, Bailey's president.

Beijing municipal government ratified registration for the project last October. Keyes expects to put the joint venture into operation at the end of this year.

The microcomputer control and automation systems to be produced by the joint venture will first be marketed in China, Keyes said.

The joint venture will help bring Chinese computer control to up-to-date levels, said Zhang Ming, the deputy director of Beijing Foreign Economic Relations and Trade Commission.

At present, preparation for the joint venture is underway. A joint working group made of Chinese and U.S. experts will conduct a feasibility study on the project at the end of this month.

Before the centre opened, it was already receiving technical assistance from a number of Chinese departments, including the ministries of power and water conservancy, chemistry, coal, and machine-building.

CSO: 4010/136

NATIONAL DEVELOPMENTS

COMMITTEE TO UNIFY SCIENTIFIC, TECHNICAL TERMS

OW251746 Beijing XINHUA in English 1250 GMT 25 Apr 85

[Text] Beijing, 25 Apr (XINHUA)--A national committee for unifying natural science and technology terms was inaugurated here today to meet the requirements of the country's rapid development of science and technology.

Addressing the inaugural meeting, noted physicist Qian Sanqiang, chairman of the committee, said that the standardization of natural science and technology terms is a pressing matter as science and technology is developing rapidly and China is opening up to the outside world. Confusion over technical terms has caused trouble in scientific information exchange, research, production and teaching, he said.

The establishment of the committee is designed to meet the challenge of a new technological revolution, especially that of information technology, Qian pointed out.

As an authoritative organ for unifying natural science and technology terms, the main tasks of the committee include working out policy and measures, publication of unified terms, collection of related data and information both at home and abroad, publication of a journal on the committee's work, and establishing contacts with foreign organizations.

The committee plans to publish two books on astronomical and bacteriological terms, each having 2,000 entries.

China began research on unifying natural science and technology terms in the 1950's, but the work was interrupted during the chaotic 10 years (1966-1976) of the "Cultural Revolution." Under the new national committee will be sub-committees concentrating on physics, mathematics, organic and inorganic chemistry, astronomy, meteorology, palaeontology, biology and geology. Sub-committees on geography, mechanics, geophysics, and aquaculture are in preparation.

Yan Yici, vice-chairman of the Standing Committee of the National People's Congress attended the inauguration, and Zeng Xianlin, vice-minister of the State Science and Technology Commission, presented certificates to 67 leading scientists who have been invited to be committee members.

[XINHUA Domestic Service in Chinese at 0840 GMT on 25 April carries a similar item on the founding of the National Committee for Unifying Natural Science and Technology Terms, adding that "State Councillor Comrade Fang Yi sent a message of greetings to the inauguration meeting."]

CSO: 4010/136

NATIONAL DEVELOPMENTS

FIRST COMPUTER ENTERPRISE IN HAINAN ADMINISTRATIVE REGION

Haikou HAINAN RIBAO in Chinese 16 Jun 84 p 1

Article by reporter Lin Youwei [2651 1429 0143] and correspondent Han Renyuan [7281 0117 0337]: "First Chinese-Foreign Joint Venture Computer Enterprise in Our Region; Xinzong Computer Development Trade Limited Company Opened Yesterday"

Text Yesterday, our region's first Chinese-foreign joint venture computer enterprise--the Xinzong Computer Development Trade Limited Company, opened for business in Haikou yesterday.

This company was jointly financed by the Peng [1756] Enterprises Company of New Zealand and the Haikou Municipal Electronics Industry Company, and is now importing from abroad two computer assembly lines and a batch of related production equipment. With the approval of relevant state departments, this company will deal in advanced work computers, electronic equipment, and electronic components, will import, assemble, and manufacture popular computers suited to middle and elementary school and enterprise management use and high level computers used for sophisticated science and technology, will develop Chinese character information processing systems and Chinese character terminals, and will continue to assemble computer projects and train computer technicians for customers. By starting in business, it will play a positive role in importing and application of computer technology in our region, training accomplished computer specialists, and accelerating the development of our island.

Yesterday morning, Wang Yuefeng [3769 6390 0023], deputy director of the Hainan Regional People's Government, Wang Daxian [3769 1129 6343], deputy mayor of Haikou City, and Huang Zhoulong [7806 3166 7893], general manager of the Xinzong Computer Development Trade Limited Company cut the ribbon opening the company. Responsible persons from the Guangdong Provincial Electronics Industrial Corporation, and the concerned departments of Hainan Region and Haikou City as well as over 240 persons representing 130 units, including the Hong Kong Huayilin Company, schools of higher learning such as Fudan University and the Electric Power Scientific Research Institute of the Ministry of Water Resources and Electric Power, scientific research agencies and Chinese and foreign enterprises participated in opening ceremonies. Congratulatory telegrams or letters came from 120 units including the Chinese Electronics Import and Export Corporation, the Ministry of Aeronautics Industry's Test Control Company, the China Future Society, and from concerned departments of the cities of Shenzhen, Zhuhai, and Zhanjiang, and from relevant enterprises from the United States, Japan, England, Singapore, New Zealand and Hong Kong.

NATIONAL DEVELOPMENTS

GUANGDONG HOLDS SCIENCE, TECHNOLOGY CONFERENCE

HK011415 Guangzhou Guangdong Provincial Service in Mandarin 0400 GMT 30 Apr 85

[Text] The provincial scientific and technological work conference ended victoriously at the Guangdong science hall this morning.

In his speech at the concluding meeting, provincial CPC committee secretary Lin Ruo stressed that properly carrying out reform of the science and technology structure is an urgent strategic task for the province. At present, it is necessary to firmly and properly grasp the following four tasks:

1. It is necessary to reform the system of allocating funds and to exercise classified control on scientific research funds to promote research institutes in serving production and economic construction.

2. It is necessary to effectively grasp the work of turning scientific achievements into commodities and to vigorously open up technological markets.

Comrade Lin Ruo pointed out that technological markets are a new thing and it is necessary to adopt an active and prudent attitude toward them, so as to ensure healthy development of technological markets. It is inappropriate to obstruct and close technological markets just because problems arise.

3. It is necessary to readjust organizations of scientific and technological departments, strengthen ties between scientific research units and enterprises, vigorously develop combines of scientific research and production, and strive to achieve greater results in this respect.

4. It is necessary to reform the personnel management system of scientific and technological personnel, bring into full play the role of existing talented people, and vigorously cultivate and discover new talented people.

Comrade Lin Ruo demanded that CPC committees and governments at all levels give meticulous guidance on reforms, adopt resolute strategies and prudent tactics, fight the first battle prudently, and make sure of winning victories. We must not carry out reforms indiscriminately and must refrain from rushing headlong into mass action. We must calmly analyze problems arising in reforms and must not be frightened out of our units. We absolutely cannot go back to the old way just because we meet problems in reforms.

The provincial scientific and technological work conference opened on 25 April. At the conference, the participants discussed five draft regulations, including the provisional regulations on reforming the management system of scientific and technological appropriations and the provisional regulations on management of technological markets. These regulations will be made public for implementation with the approval of the provincial CPC committee and the provincial government.

CSO: 4008/322

NATIONAL DEVELOPMENTS

GUANGDONG STATION URGES TECHNOLOGICAL TRANSFORMATION

HK011417 Guangzhou Guangdong Provincial Service in Mandarin 0400 GMT 30 Apr 85

[Station commentary: "The Whole Party Should Give the Green Light to Technological Transformation"]

[Text] The provincial scientific and technological work conference ended today. This conference has formulated concrete measures for implementing the decision of the central leadership on reform of the science and technology structure in the province, which will greatly promote the reform of this structure in the province.

Reform of the science and technology structure is part of and a continuation of reform of the economic structure. We must have a sense of urgency. What should our province depend on in achieving the target of doubling 3 years ahead of schedule and of quadrupling 5 years ahead of schedule? We must depend on policies, on business management, and on science and technology in particular. As an open area close to Hong Kong and Macao, Guangdong is the first to be affected by the challenge of the world's new technological revolution and the impact of the Pacific economic area. To meet this challenge, Guangdong must develop new technology, transform old equipment and technology, and build new industries. The indepth development of economic restructuring, and particularly the rapid development of commodity economy in the Zhujiang Delta zone have raised higher and higher demands on science and technology. But the current science and technology structure cannot meet the requirement of the new situation. If we fail to carry out reforms, Guangdong's four modernization cause will be hampered.

In reform of the science and technology structure which concerns the overall situation of the four modernizations, reforms, and open policies, CPC committees at all levels must strengthen their leadership over the reforms and all departments concerned must cooperate closely, make concerted efforts, give the green light to the reform of the science and technology structure, and ensure the victory of this reform.

CSO: 4008/322

NATIONAL DEVELOPMENTS

GUANGDONG SECRETARY SPEAKS AT SCIENCE, TECHNOLOGY CONFERENCE

HK020815 Guangzhou Guangdong Provincial Service in Mandarin 0400 GMT 1 May 85

[Text] At yesterday morning's closing ceremony for the provincial conference on scientific and technological work, Lin Ruo, secretary of the provincial CPC Committee, proposed in his speech: Proceeding from the overall situation of further giving play to the role of qualified persons, it is necessary to pay attention to solving well the problems of contradictions between the units of both parties in the course of the flow of qualified persons.

At this provincial conference on scientific and technological work, some representatives reported that in regard to the flow of qualified persons, some units have lacked the overall idea and have used the method of undermining other people to employ backbone technicians from some other places and units so that production, scientific research, and educational work in the units out of which qualified persons have flowed are affected.

In light of this situation, Comrade Lin Ruo said: We must resolutely implement the reform measures that qualified persons must be allowed to flow and the possession of qualified persons by units must be smashed so that it is the role of qualified persons can be given full play. However, in practical work, we must pay attention to absorbing as many retired scientists and technicians and technical workers as possible. We must not give preferential treatment by employing backbone technicians from other areas. Proceeding from the interests of the whole, units out of which qualified persons flow must allow their qualified persons not being used and their qualified persons who have not applied what they learned to flow.

CSO: 4008/322

NATIONAL DEVELOPMENTS

GANSU'S JIA ZHIJIE STRESSES ROLE OF SCIENCE, TECHNOLOGY

HK011331 Lanzhou Gansu Provincial Service in Mandarin 2300 GMT 30 Apr 85

[Text] Jia Zhijie, deputy secretary of the provincial CPC committee, delivered a speech yesterday at a provincial work conference on science and technology. He urged all economic, scientific, and technological departments across the province to really change their thinking, and to seriously implement the strategic principle of focusing the economic construction on science and technology and on gearing science and technology to the needs of economic construction, so as to expedite the pace of invigorating Gansu's economy.

Jia Zhijie said: The resolution of the CPC Central Committee on reform of the scientific and technological structures is another important strategic step taken by our party for leading the four modernizations, and for building socialism with Chinese characteristics. The general goal and requirements for reforming the province's scientific and technological structure are: Through reforms of the present set-up and personnel system of the structures, to strengthen the capacity of scientific and technological organizations for self-development, to kindle their enthusiasm for serving economic construction, to mobilize the initiative of scientific and technological workers, to make and develop more achievements and qualified personnel within a short time, to apply scientific and technological achievements to production in a prompt and comprehensive way, and to make them serve the goals of invigorating Gansu's economy and quadrupling the output value.

Jia Zhijie pointed out: Following the 3d Plenary Session of the 11th CPC Central Committee, the province has unfolded a vigorous mass campaign for studying and applying science. However, some of the province's economic, scientific and technological departments have not really changed their thinking to that of focusing the economic construction on science and technology, and making science and technology expand to meet the needs of economic construction.

He urged the economic, scientific, and technological circles to really solve this question in terms of ideology in the course of reforming the structures. In addition, the circles should use economic measures to promote the integration of science and technology with production, so that the scientific and technological achievements can be better converted into productive forces.

Jia Zhijie said: Proceeding from the province's situation, when gearing science and technology to the needs of economic construction, we must attach importance to large and medium-sized core enterprises, and most important, to peasants, town and township enterprises, and collective enterprises. This is because town and township enterprises are sparsely distributed, engage in different trades, have great potential, and are moving in the direction of large scale development. Therefore, the enterprises are the breakthrough point for invigorating the province's economy. All scientific and technological departments across the province must conduct more study and research on the province's situation of industrial and agricultural production, and do more practical work.

In his speech, Jia Zhijie stressed that in order to do well in reforming the scientific and technological structures, we must rely on the intelligence of intellectuals, and our mass work. Therefore, the key for the work is to respect knowledge and qualified personnel. Leadership at various levels must attach great importance to the significance of qualified personnel, and continue to implement the party's policies on intellectuals well amidst reforms. The leadership should assign work to them according to their abilities, and find fullest scope for their abilities. At the same time, we should handle well circulation of qualified personnel within the province; and use the research and teaching staff of the province's universities, colleges, and central units to serve its economic construction.

In addition, (Wu Wufeng), leading party group member and member of the State Scientific and Technological Commission, delivered a speech at yesterday's session.

CSO: 4008/322

NATIONAL DEVELOPMENTS

HUBEI SCIENCE, TECHNOLOGY WORK CONFERENCE OPENS

HK110331 Wuhan Hubei Provincial Service in Mandarin 1100 GMT 10 May 85

[Excerpts] A provincial science and technology work conference solemnly opened in Wuchang today. The meeting will discuss a number of views of the provincial CPC committee and government on implementing the central decision on reform of the science and technology structure, and mobilize the forces of all sectors to promote coordinated development of science, technology, the economy, and society in the province.

Vice Governor Wang Libin presided at the meeting today. In accordance with the views discussed by the provincial CPC committee and government, Huang Zhizhen, deputy secretary of the provincial CPC committee and governor, spoke on emancipating the productive force in science and technology and promoting the province's economic and social development.

Huang Zhizhen pointed out: The most important thing in reforming the science and technology structure is to respect knowledge and talent. We must adopt a variety of ways, channels, and levels to develop education so as to turn out a large number of new science and technology talented people. We must break down the old convention of departmental and unit ownership of talent, reform the simple system of allocation of talent according to plan, and integrate allocation according to state plan with selecting and hiring talented people, so as to promote the rational mobility of talented people.

CSO: 4008/336

NATIONAL DEVELOPMENTS

BRIEFS

HEILONGJIANG SCIENTIFIC, TECHNOLOGICAL EDUCATION--A scientific and technological training activity for peasants is generally conducted in rural areas of Heilongjiang Province. So far, 645 townships across the province have established scientific and technical schools, 1,582 villages have established branches of scientific and technical schools, and over 5,300 natural villages (5261 3544 1470) have established scientific and technical evening schools. Over 1 million peasants have received training. [Summary] [Harbin HEILONGJIANG RIBAO in Chinese 8 Apr 85 p 1 SK]

FIRST AUXILIARY EDUCATION NETWORK--Can you imagine students doing their lessons and taking examinations without using paper and pen? This can be done with the microcomputer assisted education network developed by Assistant Professor Xu Zekun /1776 0463 3824/ and others of Huazhong (Central China) University of Science and Technology. The use of microcomputer assisted educational networks is an area of computer technology which is currently developing very rapidly. It takes only a few minutes to input high level instructional materials and new results into the computer for others to study while it takes several months to do this with books, thus it is termed electronic teaching materials. With China's first microcomputer educational network, which was set up in less than a year, Xu Zekun and 9 other teachers and students of Huazhong (Central China) University of Science and Technology can handle over 60 microcomputers, i.e., they can provide simultaneous instruction for over 60 people. When teaching a course, the instructor need only lecture on the key points and the difficult points, and then let the computer-assisted component help the student learn. If there are any questions which the student does not understand, he can ask the computer directly. Within 1.2 km, through the network, the instructor can call up the questions asked by the student and answer them, and can correct the lessons which students have stored in the computer. The Computer Industry Management Bureau of the Ministry of Electronics Industry held an appraisal meeting on 12 June at Central China Engineering College and felt that this microcomputer-assisted educational network filled a domestic gap. /Text/ /Wuhan HUBEI RIBAO in Chinese 25 Jun 84 p 1/ 8226

SHANGHAI COMPUTER COMPANY ESTABLISHED--The Shanghai Municipal Computer Company was formally established on 27 June. This is the second such specialized company following the one in Beijing to combine research, development, production, application and service for specialized computer technology and it will play a role in promoting the development of computer industry in the Shanghai economic zone. This company already has two series and nine models of computers in production. They include the DJS-131 computer which is widely used in communications, shipbuilding, education and earthquake forecasting, and is third in output nationally. The company also produces the TQH-100 Chinese character terminal which is used for processing Chinese language information. The "Family Computer," which was recently put on the market, connects with domestic television set and tape recorder and can carry out general information storage and computing, and help children learn. /Text/ /Beijing RENMIN RIBAO in Chinese 29 Jun 84 p 3/ 8226

CSO: 4008/148

APPLIED SCIENCES

MINISTRY OF ASTRONAUTICS SPONSORS SPACE TECHNOLOGY SHOW

OW100914 Beijing XINHUA in English 0812 GMT 10 May 85

[Text] Beijing, 10 May (XINHUA)—An exhibition aimed at promoting the application of space technology as well as displaying its achievements opened today in the Military Museum of the Chinese People's Revolution.

On [display] are 2,500 items ranging from rockets and satellites to electronic components, medical instruments, household electrical appliances and cars. There are also photographic displays and models.

China has made enormous progress in astronautics over the past 30 years. It is not only one of the world's leading countries in producing rocket [boosters] and satellites, but it has also applied advanced space technology to [everyday] life, according to the Ministry of Astronautics, which organized the exhibition.

Between 1978 and 1983, over 4,800 new space technology designs and inventions won state prizes.

"We hope the exhibition and the technical exchanges to be held during the exhibition will help to further tap the potential of space technology," an official from the ministry said.

The exhibition will close 10 June.

CSO: 4010/139

APPLIED SCIENCES

NEW CARGO VERSION OF YUN-8 PASSES FLIGHT TESTS

GW131658 Beijing XINHUA in English 1622 GMT 13 May 85

[Text] Nanchang, 13 May (XINHUA)—The Chinese-built "Yun-8" cargo aircraft has just passed its most rigorous test flight at an airport in Jiangxi Province.

One of the plane's four engines was cut just before take-off and the plane forced to continue despite the dangerous deflecting force.

The test is aimed at ascertaining whether it can take off safely with one engine out of order.

The plane, made by a transport plant in Shaanxi Province, has passed other test flights over plateaus and in high and low temperatures.

The "Yun-8" has a range of 5,600 kilometers and carries 20 tons. It can be used for relief supplies, parachute drops, and geological surveys.

CSO: 4010/139

CHINA'S MARINE RESOURCES SURVEYED

Shanghai ZIRAN ZASHI [NATURE JOURNAL] in Chinese No 1, Jan 85 pp 56-59

[Article by Xu Qiwang [6079 0796 2598]: "Survey of Marine Natural Resources and Their Exploitation in Our Country"]

[Text] Our country faces wide, open ocean with a shoreline of more than 18,000 kilometers long. From the Bohai to South China Sea, it covers the temperate and torrid zones. The total sea area is about 4.73 million square kilometers. There is a great abundance of marine resources, which is an important part of our national resources. Since ancient time, our people have been endeavoring to exploit coastal marine resources. After liberation, the State has paid even more attention to ocean and carried out survey and development of offshore marine resources more systematically. In the 1970's, the survey and exploitation of our marine resources entered a new era. The advance from traditional fishery and coastal transportation to the exploitation of offshore oil, ocean transportation, marine energy sources, aquaculture and marine industrial chemicals exemplifies the vast future in the exploitation of our nation's marine resources.

1. Offshore Oil and Natural Gas Resources

Our country has abundant offshore oil and gas resources. Through general survey and explorations, six large-scale oil-and-gas-bearing basins have been discovered: The Bohai basin, South Yellow Sea basin, East China Sea basin, Zhujiang estuary basin, Beibuwan basin and Yinggehai basin. The geophysical probes and exploratory drillings both confirm that our country has good oil and gas prospect. Industrial oil gas flow has been found in many areas. According to different estimates by foreign experts, our offshore recoverable oil reserve ranges from 4 to over 10 billion metric tons, which is more than that of the North Sea oil field and is regarded as second Persian Gulf.

Our offshore oil resource investigation and exploration started in the late 1950's. Before 1979, our country carried out exploration and development on our own capital and technology, and assembled, step by step, a technical team to explore and exploit ocean oil. In recent years, the Bohai and South China Sea oil exploration bases have been established and the construction of East China Sea base is well under way. In order to accelerate the pace of offshore oil development, besides continuing to explore on our own, cooperative

exploration and development with foreign oil companies has begun since 1980. New advances have been achieved. After first-round bidding for cooperation, 18 contracts have been signed by 1983 with 27 oil companies from 9 countries—U.S., Japan, France, Great Britain, Australia, Canada, Italy, Spain, and Brazil.

The Bohai Basin area is 80,000 square kilometers. It is the seaward extension of such large oil fields as the Shengli, Dagang, and Liaohe on the Huabei basin. The sea floor connects with surrounding oil-and-gas-bearing basins. Detailed survey and explorations have been carried out here and several rich oil and gas wells have been hit. Beginning in 1980, the Sino-Franco and Sino-Japanese cooperative exploration and development have been carried out at central, western and southern sections of the Bohai. Currently, there are six exploratory wells in the Sino-Japanese cooperative exploration zone, all are found to have rich oil and gas reserves and two of them produced over 1,000 metric tons daily on test extractions. One well, which was completed on 13 February 1983, is producing 1,900 cubic meters of crude oil and 190,000 cubic meters of natural gas daily. This is by far the highest yielding well among the five known structures of Bohai. It is originally planned that, by 1986, 48 exploratory wells and performance testing wells be drilled under Sino-Japanese cooperation. However, present explorations have proved that oil prospect is very good. Therefore, it has been decided by the cooperation to hasten the exploration pace and it is estimated that all exploratory test wells will be completed by 1984 so that part of the oil field can start producing by 1986 or earlier. The oil reserve of Bohai is 5.6 billion barrels (about 784 million metric tons) by American estimate and about 753 million metric tons by Japanese estimate.

The South Yellow Sea Basin is the sea floor extension of the Northern Jiangsu oil-and-gas-bearing basin and, together with its land counterpart, forms the Northern Jiangsu-South Yellow Sea Basin. The underwater area is 87,000 square kilometers. Within the basin, there are over 40 structures with possible oil and gas deposit. The thickness of oil-bearing rock reaches 5,000 meters. There exist matured crude oil reservoirs. In 1970, our "Exploration-1" ship drilled two shallow wells at the depth of 90 meters. Later, British oil company also drilled two exploratory wells. In 1983, we have signed contracts with foreign oil companies to jointly explore the oil resources of southern South Yellow Sea basin. As a result, the exploration and development of South Yellow Sea oil will be carried out at a faster pace.

The East China Sea Basin area is 460,000 square kilometers, equivalent to the Songliao and Huabei basins combined. Oil and gas prospect is extremely good. It is divided into western, central and eastern sections. The western section begins at 34°N to the north and reaches the Pescadores in the Formosa Strait to the south, a stretch of 2,000 kilometers long. The area is about 260,000 square kilometers. The thickness of underwater sedimentary rock is over 10,000 meters and four favorable chains of oil-bearing structure have been discovered. The "Zhetongchangyuan" structure chain at western section alone has an area of 5,000 square kilometers, a huge chain unseen before in the history of our geological survey and exploration of oil. Since the drilling of first exploratory well on the East China Sea's Longjing structure about 460 kilometers southeast of Shanghai on August 1981, four wells have been

drilled by far. Among them, the Pinghu-1 well struck oil and gas flow in 1983. The well is 4,651 meters deep, currently the deepest offshore exploratory well of our country. This is another major breakthrough in the survey and exploration of East China Sea oil since last year's natural gas flow from Longjing-2 well and further demonstrates the great potential of oil and gas resources in East China Sea basin.

In the early 1960's, we did partial oil and gas resource survey at the South China Sea. The pace of probing and exploration has been quickened in the past 2 decades and the Beibuwan, Yinggehai and Zhujiang estuary basins, with a total area of 250,000 square kilometers, have been discovered and chosen. There are more than 20 exploratory wells within these three basins and more than half of them have seen industrial oil flow. Since 1980, six exploratory wells have been drilled in the Sino-Franco cooperative exploration zone at Beibuwan basin. Two of the wells produce as high as over 1,000 metric tons daily. By far, there are at least over 10 exploratory wells in Beibuwan, including 2 of our own. It is proof that there is good oil development prospect in northeastern Beibuwan. The Yinggehai basin is located in the waters southwest of Hainan island. Geophysical probes clearly demonstrate that there exists high and thick oil-bearing formation at the Tertiary period stratum. In September 1982, a contract was signed with American oil company for partial area joint exploration. The offshore drilling is currently underway. The Zhujiang estuary basin has been discovered recently. Through large numbers of geological-geophysical explorations, the boundary of this basin has been mapped. Nearly 10 exploratory wells have been drilled since 1977. The Zhu-5 well drilled in 1979 has struck industrial oil flow. The Zhu-7 well drilled in 1980 has produced crude oil when tested at the Neogene period stratum. It has now been confirmed that there is a huge and thick oil-bearing formation at the Tertiary period stratum in this basin. In 1983, a contract was signed between China and Great Britain to cooperatively explore the Zhujiang estuary. By estimate, there will be six drilling machines working in the waters of that area. In summary, the South China Sea in general and Zhujiang estuary in particular, is one of the most promising oil-bearing waters of our country.

2. Marine Aquatic Product Resources

We have large varieties of marine fish so the aquatic product resource is abundant. According to incomplete statistics, there are about 1500 varieties of fish in the four major oceans. Among them, 300 are commercial fish and over 80 varieties are high-yielding and more widespread. By estimates, the fishery resource in the continental shelf region is about 10 million metric tons, with allowable catch over 6 million metric tons.

The distribution of fish is highly localized. The South China Sea contains mainly warm water fish, the offshore areas of the Yellow Sea and East China Sea are rich in hairtails, large yellow croakers and small yellow croakers and butter fish, while in open sea there are makerel scads and others. The Bohai and North Yellow Sea contain mainly cold water fish. Other important aquatic resources include: prawns of Yellow Sea and Bohai, shrimps of Bohai, squids of East China Sea and Yellow Sea, and green turtles of South China Sea.

In addition, there are abundant mollusk and algal resources in the coastal region. The major mollusks are oysters, razor clams, clams, mussels, scallops and abalones. Among alga, kelps of Yellow and East China Sea and lavers of coastal areas (especially East China Sea area) are more abundant.

In the past 30 years, our marine production has greatly improved. There is an overall increasing trend in fishing yield. The development was particularly fast in the first 10 years after the founding of the nation, achieving an average annual increase of over 100,000 metric tons. But the rate of increase greatly reduced in the next 10 years, with average annual increase of only over 10,000 metric tons. In the past 10 years, the production has increased again, thanks to the great increase in catching capability. In 1980, the marine catch of our coastal cities and provinces is 2.813 million metric tons. Taiwan's catch is 380,000 metric tons. In addition, the catch of the neighboring countries such as Japan, South Korea and Vietnam is 3 million metric tons. The total yield reached 6 million metric tons. Currently, the catch has exceeded the allowable limit. Because of over-fishing, the marine ecological balance is upset and results in the decrease of offshore fishing resources. At present, we have formulated new policies for the development of marine fishing and adopted effective measures for the protection of resources in order to gradually change from total reliance on catching from natural resources to the policy of combining catch with aquaculture, to change irrational production structure, and to establish a good ecosystem so that production growth and development of fishing area economy can be established on the basis of steady and reliable resources. At the same time, offshore and ocean fisheries are being actively developed. In 1980, our sea aquaculture totals 2.07 million mu with annual yield of 444,000 metric tons, which is close to one-tenth of the total marine aquatic product output. Thus, from the developmental point of view, there is a great future in the development of our marine aquatic product resource.

3. Ocean Energy Sources

The term "ocean energy sources" used here mainly refers to ocean kinetic energy (tide, wave, ocean current), ocean thermal energy (sea water temperature difference) and ocean chemical energy (sea water salinity difference). In the past 20 years, there is a shortage of non-renewable, ordinary energy sources on earth, which results in the so-called "energy crisis". Development and exploitation of new natural renewable energy sources (including solar energy, wind energy and ocean energy) has again been put on the agenda of research and development. By far, certain achievements have been accomplished abroad in the research and development of ocean energy sources. It is estimated that, by early next century, ocean energy power generation will achieve large-scale utilization. The fact that we have vast waters and abundant ocean energy sources has attracted the attention of departments concerned.

We have a long and winding coastline. In many places, there are notable tidal phenomena with abundant tidal energy. After liberation, two general surveys with regard to our coastal tidal energy source have been conducted by departments concerned. According to the more recent one, the installed capacity of coastal tidal energy that can be developed and exploited is

20 million kilowatts, with annual power generation of about 58 billion kilowatt-hours. Over 90 percent of them are concentrated in eastern China (19 million kilowatts, annual power generation 53 billion kilowatt-hours), mainly in the coasts off Fujian, Zhejiang and Shanghai.

The combined installed capacity of tidal energy that by far have been developed and exploited is 4,000 kilowatts, the largest facility being the Jiangxia tidal power station located at Zhejiang's Leqingwan with the planned total installed capacity of 3,000 kilowatts. The first set of generators (500 kilowatts) started operation in 1979. The second largest is the Baishakou station at Shandong's Rubai county, with the capacity of 960 kilowatts. Furthermore, there are several small stations along the coast of Zhejiang and Guangdong.

The sites that have been identified as possible for large-scale exploitation of tidal power generation are Shanghai's Changjiang northern estuary, Zhejiang's Qiantang Jiang and Leqingwan. The estimated combined installed capacity is 6 million kilowatts. In addition, there are areas with larger average tide difference (3-4 meters) that is favorable for exploitation. For example, such areas in Shandong province have a potential installed capacity of 12,500 kilowatts, in Zhejiang 2,542,000 kilowatts, in Guangdong 693,000 kilowatts, and in Guangxi 255,000 kilowatts.

Wave energy is mainly related to wave amplitude. Generally speaking, our coastal wave is bigger in the south than north. The sea areas off the coast of eastern Guangdong, eastern Fujian and southern Zhejiang have the biggest wave, the annual average wave amplitude being 0.9-1.2 meters. The Bohai Channel and the coastal area of southern Shandong also have bigger wave, the average annual wave amplitude being about 1 meter. In other coastal areas, it is about 0.4-0.8 meter. The open sea waves are bigger than the coastal ones. Around the Paracel Islands, average wave amplitude reaches about 1.4 meters. Also, our coastal areas are influenced by seasonal winds and the waves show obvious seasonal changes, bigger in winter and smaller in summer. Especially under the blow of strong wintry northerly wind, a big wave band stretching in the direction of northeast to southwest is formed from the Yellow Sea to South China Sea. The average wave amplitude is over 2 meters. The waves have the characteristics of high amplitude and low period and is very favorable for wave energy exploitation. Assuming an average wave amplitude of 1 meter, our coastal per-meter wave energy is about 5 kilowatts. By this calculation, the coastal wave energy reserve along the continent reaches 150 million kilowatts with 30-35 million kilowatts exploitable, which is comparable to tidal energy. The open sea wave energy is even greater. Assuming wave amplitude of 2-3 meters, then per-meter wave energy is about 20-40 kilowatts. Recently, somebody, by using computer, made estimations of the wave energy of whole Chinese waters. The theoretical total power of wave energy reaches 574 billion kilowatts, with Bohai's about 11 billion, Yellow Sea's about 47 billion, East China Sea's about 133 billion, and South China Sea's about 383 billion. Due to the lack of sufficient observation data of wave energy, it is apparently over-estimated. Even so, a thousandth of it is still more than 500 million kilowatts and it is obvious that this is a tremendous reserve.

Like foreign countries, our current wave energy exploitation is mainly focused on the research of small-scale wave energy power generating device to be used as power source for such things as guiding lanterns and buoys. A Shanghai's department concerned succeeded in making a wave energy power generating device that can generate electricity under the condition of gentle breeze (3 on Beaufort scale) and 0.2 meter wave amplitude with maximum capacity reaches 60 watts. Power generated in 1 day is enough for one guiding lantern to last 3 days. Also, an innovative "wave turbine" has been designed and studied and hence opens up a new approach in our research on wave energy exploitation.

A large portion of solar energy the earth received is stored in the ocean surface, especially the tropical sea surface. The surface temperature is constantly kept at 26-28°C while deep down, the water temperature stays in single digit centigrade year-round, and hence forms the temperature difference between ocean surface and deep below the surface. This kind of thermal energy can be utilized to generate electricity. On-site tests have been carried out abroad. In the U.S., small-scale sea-thermal power generation has been successfully tested on waters near Hawaii and the research and test of commercial power generator is scheduled to be completed by 1990. Other countries are also pursuing. It is generally accepted that a temperature difference of 18°C or more is worthy of exploiting. The South China Sea is located in the tropical zone, with an area of about 3.6 million square kilometers and the average depth of over 1,000 meters. The surface temperature in most parts of the area is 25-28°C. The temperature difference is about 20°C and is suitable for thermal energy development. By some rough estimates, the potentially exploitable thermal energy reserve is about 500 million kilowatts. At present, the research on sea-thermal power generation has been included in the scientific research plan.

Furthermore, currents prevail in our coastal areas. Big currents exist, with abundant current kinetic energy, in the Bohai Channel, Chengshantou area, northern Jiangsu coast, and the waters from Changjiang estuary to Zhoushan islands. A model study of current power generation has been done in the waters around Zhoushan islands. But the total coastal current energy has not been estimated. We have many rivers, large and small. The annual influx into the sea is about 2-3 trillion cubic meters from the estuaries of such big rivers as the Changjiang, Zhujiang, and Huanghe. In these mixing regions of fresh water and sea water, there exist big salinity difference and the estimated energy is over 100 million kilowatts. Theoretical studies on the utilization of this salinity difference to generate electricity have just begun abroad. There is no such study in our country.

4. Seawater Chemical Resources

Seawater contains near 80 chemical elements. Over 10 of them exist in higher concentration, including chlorine, sodium, calcium, potassium, magnesium, sulfur, bromine, carbon, strontium, and boron. Some materials such as sea salt exist in tremendous quantity. World oceans contain 4.8×10^{16} metric tons of salt, i.e. 20 million cubic kilometers, while others such as uranium exist in minute quantity. There are only 3 mg in each metric ton of seawater.

However, the total amount of uranium in ocean is quite big, about 4 billion metric tons, which is 3,000 times more than the deposit on land. It is estimated that every cubic kilometers of seawater contains 3.75 million metric tons of chemical materials with total value of 1 billion dollars. Therefore, seawater itself is an important marine resource. Many countries are doing developmental study. Currently, salt manufacture and magnesium, bromine extraction from seawater have been achieved abroad and commercial developments have been realized.

We have substantial background and achievements in the development and exploitation of seawater resource. Not only that we lead the world in salt manufacture from seawater, but that we have made big progresses in the comprehensive utilization of salt brine resource and the direct extraction of chemical materials from seawater. According to statistics, the total area of our coastal salterns is 4.78 million mu with 1,356,000 metric tons of sea salt produced annually. The development of salt manufacturing from seawater provides favorable condition for the comprehensive utilization of seawater resource. At present, there are more than 50 salt chemical plants that are able to extract more than 30 kinds of chemical product from bittern. More than 10 varieties, including potassium chloride, bromine, Glauber's salt, anhydrous saltpetre, brine lump, magnesium sulfate, lightweight magnesium carbonate, lightweight magnesium oxide, hydrochloric acid, chlorine, caustic potassium, caustic soda, potassium-magnesium fertilizer, and chloride-potassium-magnesium fertilizer, are formally produced.

In the past 20 years or so, advances have been made in the study of direct extraction from seawater some chemical elements (mainly potassium, iodine, bromine, and uranium). In 1972, the Tianjin Salt Manufacture Institute and the Geology Institute of the Chinese Academy of Sciences have succeeded in extracting potassium chloride from seawater by natural zeolite adsorption method. Later, Qingdao Chemical Engineering Institute and Qingdao Phosphorus Fertilizer Plant carried out scale-up test production. Sixty metric tons of potassium chloride was produced in 1976. In the same year, Lianyungang Chemical Engineering Institute produced 20 metric tons of potassium chloride by the same method. Both are currently planning the construction of potassium extraction plant with yearly production capacity of 500 metric tons. The study of bromine and iodine extraction from seawater also enters small-scale test stage, especially true for bromine extraction. The Tianjin Salt Manufacture Institute has succeeded in bromine extraction from seawater by using resin adsorption method and planned to carry out intermediate scale-up of 200 metric tons annual production in 1985. Uranium extraction is currently still at research stage. But progresses have been made in the research of uranium adsorbent.

Due to the rapid growth of coastal cities and populations, fresh water has become a crucial resource. To get fresh water from seawater has become a priority in many countries and fast advance has been made. At present, there are 1,000 desalination plants built worldwide with daily production of 1.3 million cubic meters. The technology of desalination has practical application. In our country, the study of desalination process began in 1958 and mainly concentrated on electrodialysis technology study. It has

advanced to the application stage. At present, there are over 100 organizations involved in the production of electrodialysis devices. Single machine desalination capacity has advanced from several metric tons per day to several thousand. The drinking water of Tianjin's Dagang oil field area, the water for production use at Beijing Chemical Plant, the water consumed at Shanghai's Chongming power plant, and the fresh water at Jinshanwei chemical industrial zone are all produced by large-scale electrodialysis desalination devices. However, they all use bittern desalination technology. It is only recently that seawater desalination technology is developed with limited applications. Only small numbers of island and ship use the electrodialysis desalination device. At Paracel Islands, a fresh-water-making machine with daily production capacity of 200 metric tons has been completed on June 1981, by far the largest desalination device in our country. Moreover, to solve the water problem of Tianjin municipality, the construction of a large-scale distillation desalination plant is being considered.

Overall, our exploitation of seawater resources is at early stage of development. At present, some products are unable to meet the demands of the nation. Every year, large sum of foreign exchange has to be spent to import such products as potassium, bromine, and iodine. Therefore, it is an important task in the development and exploitation of marine resources that the development and exploitation of our seawater resources be accelerated.

5. Ocean Space Resources

The modern development and utilization of ocean space has advanced from traditional harbor, transportation, and reclaimed land cultivation to the construction of man-made island, sea air-field, underwater storage, sea bottom tunnel, and cross-ocean bridge. Especially, the development of ocean oil fields has stimulated the advances in the areas of underwater oil storage and oil delivery systems. Those developed countries with small land size, such as Japan, Netherland, Singapore, and Great Britain, have emphasized more on the development of ocean space resources.

At present, the development and utilization of ocean space in our country is limited mainly to the areas of diked field and transportation. We have about 20 million mu of reclaimed land, which are mainly used for the development of cultivation. Since liberation, over 10 million mu nationwide have been reclaimed and cultivated. Zhejiang, Fujian, and Liaoning provinces alone have cultivated 4.1 million mu from 1950 to 1979. There are large populations and scarce lands on our coastal provinces and cities. Reclaiming land from sea has been an important goal in the development of ocean space and has played certain role in the development of economy. For example, Zhejiang province produced 260 million jin of grains, nearly 200 million jin of cane sugar, 24 million jin of edible oil, 16 million jin of cotton and 1.77 million jin of aquatic products on reclaimed land in 1979. However, there is a certain lack of foresight in our reclaimed field cultivation. Often it is based on single economic consideration and lacks overall planning and comprehensive utilization. As a result, there exist quite a few contradictions and problems.

In the area of ocean transportation, great progresses have been achieved within past 2 decades in ocean-going transportation and harbor construction. The total tonnage of our ocean transport vessels was only over 10,000 in the early 1960's and reached 9.63 million by 1980. This ocean fleet not only includes all types and classes of cargo ships, but also consists of a certain number of large size bulk cargo freighter and oil tanker. In recent years, several newly built and technologically advanced new model RO/RO ships, container ships, and multi-purpose ships have been added. At present our commercial ships are sailing among over 400 ports in more than 100 countries and territories. In 1980, the tonnage of ocean cargo transportation was 4,281,000. Because of the rapid growth of sea transportation, harbors have become increasingly congested. In 1973, the State decided to expand and build harbors and anchoring berth. Through several year's efforts, the appearance of harbor begins to change. By 1983, there are more than 300 anchoring berth, 143 of them are deep water berth for 10,000 ton class. At present, there are over 80 large and small harbors on our coast with annual handling capacity of 20-30 million tons. But that is still not enough to meet the demands of the ever growing ocean transportation. The State is continuing the development of harbor construction. Besides, due to the development of offshore oil, harbors and sea transportation will be strained even more. Departments concerned are considering the development of under-water oil delivery and oil storage system.

6. Marine Medicinal Resources

We have a long history in utilizing marine lives as therapeutic medicines. According to studies, the "Shanhaijing" of the Warring States period recorded 27 kinds of marine medicines (fish and turtles). Later, in over 20 ancient medical books ranging from "Shennongbencaojing" of Eastern Han Dynasty and "Bencaoshiyi" of Tang Dynasty to "Bencaogangmu" by Li Shizhen of Ming Dynasty and "Bencaogangmushiyi" of Cing Dynasty, more than 100 varieties of marine medicinal resources and their efficacies were recorded. It is obvious that we have a history of at least over 2,000 years in the application of marine pharmaceuticals. Along with the development of our modern medicine, there are great advances in the research and development of marine medicinal resources, especially after the 1960's. There are new developments both in the variety of marine life for medicinal use and in the efficacy and application. Many marine lives have been found to contain substances having such pharmacological activities as antibacterial, antiviral, hemostatic, anti-coagulant, and antitumor. Some progresses have also been made in the clinical application study of some medicinal marine lives.

We have abundant medicinal marine life resource, which is a part of our great pharmaceutical treasures. According to preliminary statistics, there are over 700 varieties of medicinal marine life near our coast. In 1978, the Hygienics division of Navy's Logistics Department sorted out 275 varieties. Among them, the majority are fish, mollusks and alga with 89, 67, and 64 varieties respectively. In addition, there are 21 arthropods, 19 echinoderms, 5 coelenterates and 4 reptiles, 3 mammals and 4 others. The majority of these medicinal marine lives are distributed in the Bohai, Yellow Sea, East China Sea and South China Sea. The distribution trend is that the number

increases from north to south. There is still no planned and organized systematic survey and investigation (only scattered investigations) of our medicinal marine life resources (including taxonomy, distribution, yield, ecological environment, and medicinal values). On the aspect of development and utilization, the majority are still at application study stage with the exception of kelp. Some studies have obtained results. But there are difficulties in large-scale development and utilization because of the high cost of obtaining the medicinal materials. Their future are linked to breakthrough in technology and economy. It is believed that the most promising medicinal marine lives are mainly alga and anthozoa.

The development of ocean has become one of the important driving forces in the new world industrial revolution. We have abundant marine resources and great potential in their development and exploitation. The rational development and exploitation of these marine resources no doubt has extremely important significance to our socialist modernization constructions. The State, from the view-point of long-term economic development strategy, is strengthening the management and planning of ocean development and is doing preliminary work for the advancement of ocean development, which includes carrying out marine resources survey, the study of marine engineering technologies, marine development service, and marine environmental protection. We believe that in the late 1980's, there will be greater advances in the development and exploitation of our marine resources, which will contribute more and more to the development of national economy.

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APPLIED SCIENCE

DETERMINATION OF SINGLE-MODE OPTICAL FIBER DISPERSION

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[Article by Zhou Wenjun [0719 2429 0193] of Wuhan Institute of Posts and Telecommunications Science: "Determination of Dispersion in Single-Mode Optical Fibers From Relative Operating Wavelength and Other Parameters"]

[Text] Abstract

On the basis of theoretical analysis and a large number of numerical calculations, an approximate analytic formula is proposed to determine the dispersions of single-mode optical fibers from the relative operating wavelength $\bar{\lambda}$, the relative refractive index difference Δ and the core radius a of the fibers. Additionally, important parameters, such as the propagating constant and the ratio of power flow in the core of the single-mode optical fibers, can also be calculated by means of the related formulae given in the paper.

I. INTRODUCTION

It is well known that the total dispersion of a single-mode optical fiber is very small because it does not disperse within the mode. When operating in the $1.3 - 1.5 \mu\text{m}$ region, the bandwidth is above $10 \text{ GHz}\cdot\text{km}$ which makes it an ideal transmission medium for long range, high volume communications. This extremely small dispersion coefficient is a distinct advantage, however it also introduces difficulties and problems to its measurement. Conventional methods for measuring multi-mode optical fiber dispersion cannot be directly applied. Current methods to measure single-mode optical fiber dispersion require costly equipment, especially light sources with tight specifications. On the other hand, in theory, dispersion can be calculated as long as the distribution of the index of refraction of the single-mode fiber is known [1,2]. However, this calculation is rather complicated. Therefore, it is significant to find a simple method to calculate the dispersion of a single-mode optical fiber based on easily measurable parameters of the fiber for engineering use.

Cut-off frequency is a basic parameter of the single-mode fiber which can be measured easily. Furthermore, as long as the distribution of the index of refraction of the fiber core is known, then the normalized cut-off frequency of its LP_{11} mode can be calculated as well [3]. Can we determine the dispersion of a single-mode optical fiber from its cut-off frequency? This is the

question of interest. Through theoretical analysis and a large number of numerical calculations, we found a simple approximation which could be used to calculate dispersion from optical fiber parameters such as the cut-off frequency. When the relative operating wavelength $\bar{\lambda}$ (i.e. the ratio of the operating wavelength to the cut-off wavelength), relative refractive index difference Δ and core radius a are known, the dispersion index of this fiber can be quickly calculated based on the formulas and tables given in this paper. The accuracy is adequate for engineering use. This method facilitates the design, manufacture and measurement of single-mode optical fibers.

II. SIMPLIFICATION OF DISPERSION FORMULA

From reference [2] we know that the dispersion within a particular mode can be divided into three components; i.e.

$$S = S_o + S_d + S_x \quad (1)$$

$$S_o = - \left\{ (1+2\Delta H) - \frac{d}{d\lambda} \left(\lambda^2 \frac{d\rho}{d\lambda} \right) + \left[4\Delta' K - \frac{(1+2\Delta H)^2}{2(\rho+\mu)} \left(\lambda \frac{d\rho}{d\lambda} \right)^2 \right] \right\} / (4\pi c \sqrt{\rho+\mu}) \quad (2)$$

$$S_d = - \left[\rho H - \frac{d}{d\lambda} \left(\lambda^2 \frac{d\Delta}{d\lambda} \right) + \rho^2 \left(2K - \frac{H^2}{\rho+\mu} \right) \left(\lambda \frac{d\Delta}{d\lambda} \right)^2 \right] / (2\pi c \sqrt{\rho+\mu}) \quad (3)$$

$$S_x = - \left\{ 2H + \rho \left[4\Delta K - \frac{H(1+2\Delta H)}{\rho+\mu} \right] \right\} \lambda^2 \frac{d\rho}{d\lambda} \frac{d\Delta}{d\lambda} / (2\pi c \sqrt{\rho+\mu}) \quad (4)$$

Where S_o is the dispersion on the optical scale due to the changing optical dimension ρ of the fiber with operating wavelength, S_d is the distributed dispersion caused by varying refractive index difference Δ with changing operating wavelength, and S_x is the cross dispersion caused by mutual changes of ρ and Δ due to varying wavelength. Parameters in eq(2)–eq(4) are defined as follows:

$$\rho = \left(\frac{2\pi a}{\lambda/n_c} \right)^2 = k^2 n_c^2 a^2 \quad (5)$$

$$\Delta = \frac{n_c^2 - n_s^2}{2 n_c^2} \quad (6)$$

$$\mu = w^2 = (\beta^2 - k^2 n_c^2) a^2 = \beta^2 a^2 - \rho \quad (7)$$

$$v = v^2 = 2 k^2 n_c^2 a^2 \Delta = 2 \rho \Delta \quad (8)$$

$$H = \frac{d\mu}{dv} \quad (9)$$

$$K = \frac{d^2 \mu}{dv^2} = \frac{dH}{dv} \quad (10)$$

Under the following condition $|\frac{d\Delta}{d\lambda}| < \Delta \ll 1$, eq(2)–(4) can be simplified as:

$$S_o = [1 + \Delta(2H - b)] C_o - 2\Delta[(2V'K + b - H) - 2\Delta(H - b)](1 - \Delta b) C_o \quad (11)$$

$$S_d = -H C_o \quad (12)$$

$$S_x = -(2V'K + H) C_o \quad (13)$$

When the envelop is fused quartz and the core is doped quartz, the above coefficients are defined as follows:

$$C_0 = C_1 - C_2 \quad (14)$$

$$C_1 = \left(\lambda \frac{d\rho_0}{d\lambda} \right)^2 / 8\pi c \rho_0^{1/2} = \frac{8\pi^2}{c\rho_0^{1/2} \lambda^2} \left[1 + \sum_{i=1}^n \frac{a_i \lambda^2}{(\lambda^2 - b_i)^2} \right] \quad (15)$$

$$C_2 = \frac{d}{d\lambda} \left(\lambda^2 \frac{d\rho_0}{d\lambda} \right) / 4\pi c \rho_0^{1/2} = \frac{1}{4\pi c \rho_0^{1/2}} \left[-\lambda \frac{d\rho_0}{d\lambda} + 32\pi^2 \lambda^3 \sum_{i=1}^n \frac{a_i b_i}{(\lambda^2 - b_i)^3} \right] \quad (16)$$

$$C_3 = \frac{d}{d\lambda} \left(\lambda^2 \frac{d\Delta}{d\lambda} \right) \rho_0^{1/2} / 2\pi c = \frac{\rho_0^{1/2}}{2\pi c} \left[\left[3 + 4 \frac{\lambda^2}{n_0^2} \sum_{i=1}^n \frac{a_i b_i}{(\lambda^2 - b_i)^2} \right] \lambda \frac{d\Delta}{d\lambda} - 4 \frac{\lambda^3}{n_0^2} \times \right. \\ \left. \times \left[(1+2\Delta) \sum_{i=1}^n \frac{a_i b_i}{(\lambda^2 - b_i)^3} - \sum_{i=1}^n \frac{a_i^2 b_i^2}{(\lambda^2 - b_i)^4} \right] \right] \quad (17)$$

$$C_4 = \lambda^2 \frac{d\rho_0}{d\lambda} \frac{d\Delta}{d\lambda} / 2\pi c \rho_0^{1/2} = \frac{4\pi}{c \lambda^2 \rho_0^{1/2}} \left(\lambda \frac{d\Delta}{d\lambda} \right) \left[1 + \sum_{i=1}^n \frac{a_i \lambda^2}{(\lambda^2 - b_i)^2} \right] \quad (18)$$

where

$$\lambda \frac{d\Delta}{d\lambda} = \frac{\lambda^2}{n_0^2} \left[(1+2\Delta) \sum_{i=1}^n \frac{a_i b_i}{(\lambda^2 - b_i)^3} - \sum_{i=1}^n \frac{a_i^2 b_i^2}{(\lambda^2 - b_i)^4} \right] \quad (19)$$

In the above coefficients, $\{a_i\}$ and $\{b_i\}$, and $\{a_i^2\}$ and $\{b_i^2\}$ are the Sellmeier coefficients of pure fused quartz and doped quartz, respectively. ρ_0 is the optical dimension when the core radius is $a=\mu$, i.e.

$$\rho_0 = \lambda^2 n_0^2 = 4\pi^2 \left(\frac{1}{\lambda^2} + \sum_{i=1}^n \frac{a_i}{\lambda^2 - b_i} \right) \quad (20)$$

It is worthwhile to point out that C_0 is the dispersion coefficient of the envelop, i.e.

$$C_0 = -\frac{\lambda}{c} \frac{d^2 n_0}{d\lambda^2} \quad (21)$$

Based on eq(14) - (19), it is not difficult to calculate these values at a specific operating wavelength from the Sellmeier coefficients given in reference [4]. The variations of C_0 , C_1 , C_2 and C_3 with operating wavelength or maximum dopant concentration in the core at several low loss windows (i.e. $0.85 \mu\text{m}$, $1.2 \mu\text{m}$, $1.3 \mu\text{m}$ and $1.55 \mu\text{m}$) are shown in Figures 1 to 3. If the maximum germanium doping level in the core of the maximum relative refractive index difference Δ is known, values of C_0 to C_3 corresponding to a particular operating frequency can be looked up from these figures.

III. APPROXIMATION FORMULA INVOLVING b, H AND K

To accurately calculate structural parameters b , H and K of a single-mode optical fiber is usually complicated. Based on a great deal of calculations in the range of $0.7 < \bar{V} < 1.1$, b , H and K can be expressed in terms of the normalized frequency \bar{V} and normalized cut-off frequency \bar{V}_c as:

$$b = \frac{W^2}{\bar{V}^2} = \frac{B}{\bar{V}} \approx c b, \quad (22)$$

$$H = \frac{d\mu}{d\bar{V}} \approx (A + B|\bar{V} - 0.7|) H_c, \quad (23)$$

where b_0 and H_0 represent the normalized propagating constant and its derivative with respect to V , respectively.

$$b_0 = \left[\frac{(\bar{V}^2 - 1.31155 \bar{V} + 0.30799) \bar{V}}{0.1226145 - 0.25622 \bar{V} + 1.10174 \bar{V}^2 - 0.96325 \bar{V}^3} \right] \quad (24)$$

$$H_0 = 1 - \exp \left[\frac{-(\bar{V}^2 - 0.41751 \bar{V} + 0.07981) \bar{V}}{0.20324 - 0.44217 \bar{V} + 0.6158 \bar{V}^2} \right] \quad (25)$$

A, B and C in (22) and (23) are coefficients which include \bar{V}_c :

$$A = \frac{1.7972 - 5.7719 \bar{V}_c + 5.1862 \bar{V}_c^2 - 0.2115 \bar{V}_c^3}{\bar{V}_c^2} \quad (26)$$

$$B = \frac{(\bar{V}_c - 1)^{1/2}}{33.332 - 31.969 \bar{V}_c + 10.703 \bar{V}_c^2} \quad (27)$$

$$C = \frac{2.14 - 6.49 \bar{V}_c + 5.6 \bar{V}_c^2 - 0.25 \bar{V}_c^3}{\bar{V}_c^2} \quad (28)$$

The relative normalized frequency \bar{V} , relative cut-off frequency \bar{V}_c , and relative operating wavelength $\bar{\lambda}$ are defined in the following, respectively.

$$\bar{V} = V/V_c \approx \lambda_c/\lambda = 1/\bar{\lambda} \quad (29)$$

$$V_c = V_c/2.40483 \quad (30)$$

$$\bar{\lambda} = \lambda/\lambda_c \quad (31)$$

The relative normalized cut-off frequency \bar{V}_c is the ratio of the normalized cut-off frequency of an optical fiber V_c to the normalized cut-off frequency of a step optical fiber which is 2.40483. The relative normalized frequency is the ratio of the normalized frequency of a specific fiber to its normalized cut-off frequency, which is almost inversely proportional to the relative operating wavelength (ratio of operating wavelength to cut-off wavelength). Obviously, the operating condition of a single-mode optical fiber is $\bar{V} \leq 1$ or $\bar{\lambda} \geq 1$.

We know from the above that when the relative operating wavelength $\bar{\lambda}$, relative refractive index difference Δ and core radius a are known, b and H can be easily calculated. As for the term $V^2 K$ in the simplified dispersion equation, it can be obtained by taking the derivatives of eq(23) and (25).

$$2V^2 K - V \frac{dH}{dV} = B\bar{V}H, \text{Sgn}(\bar{V} - 0.7) - \left(\frac{H}{H_0} - H \right) \ln(1 - H_0) \times \\ \times \frac{(3\bar{V}^2 - 0.83502\bar{V} + 0.07981) - (0.44217 - 1.2316\bar{V}) \ln(1 - H_0)}{\bar{V}^2 - 0.41751\bar{V} + 0.07981} \quad (32)$$

IV. DETERMINATION OF DISPERSION IN SINGLE-MODE OPTICAL FIBER

1. Procedures. First, the coefficient C_0 , C_1 , C_4 , and C_5 corresponding to the operating frequency are found from Figures 1-3 from the maximum relative refractive index difference Δ or the maximum germanium doping level. Then, the relative normalized frequency $\bar{V} = \frac{\lambda_0}{\lambda}$ is determined by measuring the cut-off frequency λ_0 from the given operating frequency λ . It is followed by calculating the relative normalized cut-off frequency \bar{V}_0 from the core radius and relative refractive index difference.

$$\bar{V}_0 = \frac{2\sqrt{2} n_c(\lambda_0) \Delta \sqrt{\Delta}}{2.40483} \quad . \quad (31)$$

where $n_c(\lambda_0)$ is the index of refraction of the envelop at the cut-off wavelength. Thirdly, calculated values of \bar{V} and \bar{V}_0 are substituted into eqs (22)-(28) and (32) to determine the values of b , H and $2V^2K$. They are subsequently plugged into simplified dispersion formulas (11)-(13) to calculate the dispersion.

2. Results. In order to investigate the accuracy and reliability of this method, we calculated dispersions under a wide range of maximum germanium doping level and core radius with optical fibers of different refractive index distributions at various wavelengths. Results were compared to those obtained from corresponding numerical computations. It was found that when the relative normalized frequency is in the actual operating range of $0.7 < \bar{V} < 1.1$, the two methods are equivalent. In addition, we calculated the dispersion index of an extremely low loss, 0.2 db/km ($\lambda = 1.55 \mu\text{m}$) single-mode optical fiber from parameters reported in reference [5] ($\lambda_c = 1.1 \mu\text{m}$, $\Delta = 0.194\%$, $a = 4.7 \mu\text{m}$) and the result was found to be in agreement with the measured value. These results are shown in the following figures and table (see Figures 4 and 5 as well as Table 1).

Table 1. Comparison of Dispersion of Extreme Low-loss Single-mode Optical Fiber by Different Methods

Method	This Work	Measured [5]	Calculated [2]
$S(\text{PS}/\Delta \cdot \text{km})$	1.622	1.7	1.619

V. APPROXIMATE FORMULAS FOR NORMALIZED CUT-OFF FREQUENCY AND RATIO OF POWER FLOW IN LP_{11} MODE

The refractive index distribution for an exponential optical fiber can be expressed as

$$n(r) = \begin{cases} n_c \left[1 + 2\Delta \left(\frac{r}{a} \right)^2 \right]^{\frac{1}{2}} & r \leq a \\ n_c & r > a \end{cases} \quad . \quad (34)$$

where n_0 is the index of refraction of the envelop. The variation of the normalized cut-off frequency of this type of LP₁₁ mode fiber with the exponent α was accurately calculated in reference [3]. The relation was also expressed as an equation in another reference [7]:

$$F_c = 2.405\sqrt{(\alpha+2)/\alpha} \quad (35)$$

We rewrote this formula as:

$$\bar{F}_c = \sqrt{1 + 2.32/\alpha} \quad (36)$$

There was significant improvement over eq(35) and the relative error was under 1 percent (see Table 2).

Table 2. Comparison of Precise and Approximate Values of Normalized Cut-off Frequency in LP₁₁ Mode

α	∞	100	20	10	8	4	3	2	1	$\frac{1}{2}$	$\frac{1}{4}$
Precise value	2.4048	2.4295	2.5270	2.6493	2.8882	2.9996	3.1809	3.5181	4.3818	5.7343	7.7636
\bar{F}_c Calculated from (36)	2.4048	2.4235	2.5405	2.6692	2.9097	3.0228	3.2024	3.5343	4.3818	5.7111	7.7104
Relative error	0	1.23×10^{-4}	5.84×10^{-5}	7.61×10^{-5}	8.14×10^{-5}	7.73×10^{-5}	6.78×10^{-5}	4.8×10^{-5}	4.58×10^{-5}	4.05×10^{-5}	6.75×10^{-5}

Conversely, if \bar{F}_c is known, the effective α of the fiber can be calculated based on eq(36):

$$\alpha = 2.32/(\bar{F}_c^2 - 1) \quad (37)$$

The core power, P_{core} , formula in an optical fiber was given in reference [6].

$$\rho_{core} = \frac{\alpha+2}{2\alpha} (bV)^2 + \frac{\alpha-2}{2\alpha} b \quad (38)$$

where b is the normalized propagation constant, V is the normalized frequency, P_{core} is the core power flow percentage, and the prime (>) indicates differentiation with respect to V . In order to facilitate computation, this formula is simplified as:

$$\rho_{core} = H + \frac{2}{\alpha} (H - b) \quad (39)$$

For a step single-mode fiber, $\alpha \approx b$. Then, $P_{core} = H$. By substituting (36) into (39), we get

$$\rho_{core} = H + 0.8621(\bar{F}_c^2 - 1)(H - b) \quad (40)$$

Based on the above analysis, we know that all parameters can be found once λ , Δ and α are known. Then, P_{core} is available. Figure 6 shows P_{core} vs. normalized frequency curves with various α using the calculated values and approximate values derived in this work.

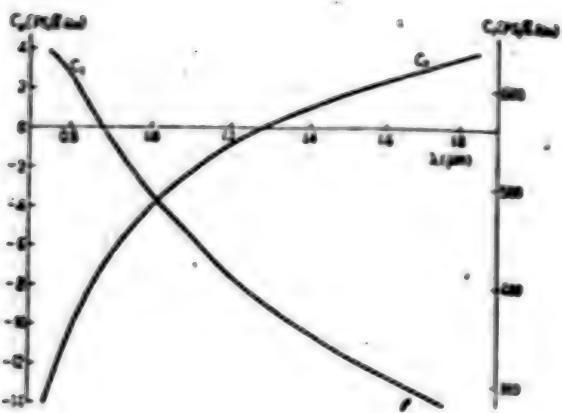


Figure 1. Variation of C_0 , C_1 with Operating Frequency

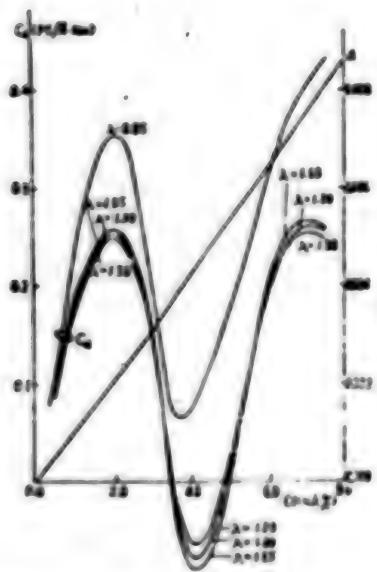


Figure 2. Relative Core Refractive Index Difference and C_0 vs. Maximum Germanium Doping Level

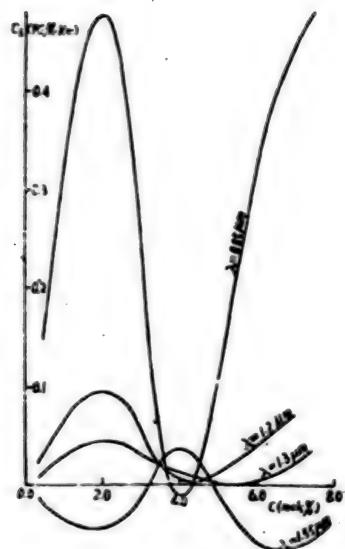


Figure 3. C_5 vs. Maximum Germanium Doping Level

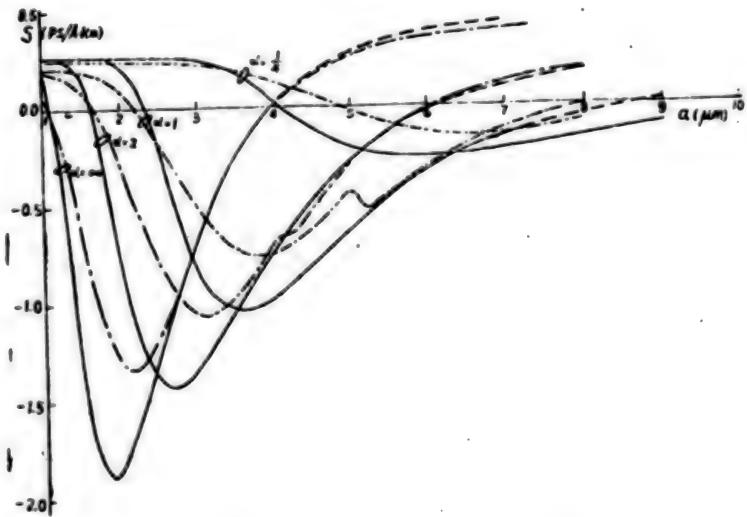


Figure 4. Dispersions of Various Single-mode Fibers at Low Loss Window = $1.3 \mu\text{m}$ vs. Core Radius. (Maximum Ge Doping Level is 3.5 mole%)

— calculated in reference [5] (dotted line in non-single-mode region, i.e. $\bar{V} > 1$); —— this work.

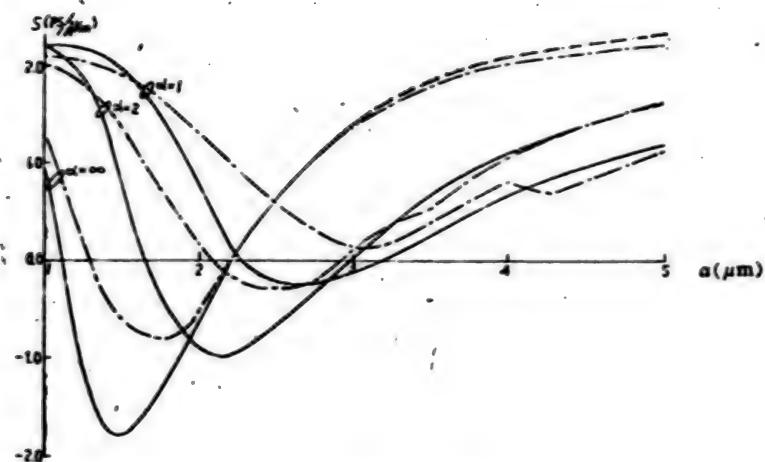


Figure 5. Dispersions of Various Single-mode Fibers at Low Loss Windows = $1.55 \mu\text{m}$ vs. Core Radius. (Maximum Ge Doping Level is 7.9 mole%)

— — — calculated in reference [5] (dotted line in non-single-mode region, i.e. $\bar{V} > 1$); — · — — from equations of this work.

VI. CONCLUSIONS

A finite element variation method was used in this work to derive approximate analytic formulas for b , H and K on the basis of a large number of numerical calculations. These formulas may be applicable to single envelop single-mode optical fibers which do not deviate greatly from the power distribution law. The dispersion of a fiber can be conveniently calculated based on these formulas together with Sellmeier coefficient curves of fused quartz at various germanium doping levels if basic parameters such as the relative operating frequency, relative refractive index difference and core radius are available. In addition, various transmission parameters and ρ core can also be obtained. The accuracy is adequate for engineering applications. It is a convenient way for the design, manufacture and measurement, as well as for understanding the transmission properties, of single-mode optical fibers.

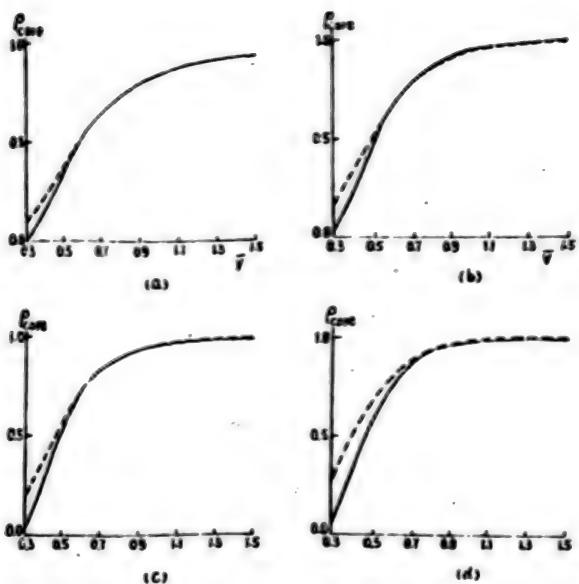


Figure 6. Single-mode Optical Fiber Core Power Flow Ratio vs. Relative Normalized Frequency

(a) step ($\alpha \rightarrow \infty$); (b) parabolic ($\alpha=2$); (c) triangular ($\alpha=1$); (d) $\alpha = \frac{1}{2}$
 ----- numerical calculation this work

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12553
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APPLIED SCIENCES

CHINESE CHARACTER PRINTER FOR PDP11/23 SYSTEM DESCRIBED

Beijing WEI JISUANJI YINGYONG [MICROCOMPUTER APPLICATIONS] in Chinese
No 4, Nov 84 pp 61-62

[Article by Wang Xinshe [3769 2450 4357], Institute of Acoustic
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[Text] The TH-2100 (mo M2200) high-performance dot-matrix printer is capable of printing Chinese characters and is widely used in China. It has a 24-pinprinthead suitable for Chinese hardcopy output. However, it also has a disadvantage: in addition to containing eight data lines plus some generalpurpose control lines, it external interface also requires another control line (the MODE-20 line) for determining whether the printer is to output Chinese characters or ordinary ASCII characters. When the MODE-20 line is high, the 8 data bits are interpreted as the code for ASCII or Japanese kana characters; a low voltage on the MODE-20 line causes the 8 bits input to the printer to be interpreted as part of the bit-mapped matrix for a Chinese character. Since 3 data words (or 24 bits) represent each row, 72 bits must be input to represent each Chinese character if a 24 x 24 matrix pattern is used. Adequate hardware for the MODE-20 line is not provided on general-purpose 8-bit parallel printer interfaces. On the other hand, if a manual switch is used to control printer operation only the Chinese character or the ASCII mode can be used during data output; Chinese characters and ASCII symbols cannot be mixed.

However, many business systems require output with both Chinese characters and numeric symbols; for example, payrolls usually consist almost entirely of numerals, except for employees' names. If these numbers were to be printed out in the same way as the Chinese characters, printing speed would become intolerably slow. Some method is therefore necessary for controlling the MODE-20 line by software. We slightly modified the LPV-11 interface board (made by General Electric corp for the PDP11/23) to adapt it for use in our computer system.

The Z3 component (DC003) of the LPV-11 interface contains a redundant flip-flop (equivalent to a D flip-flop), and the Z15 component (74366) contains a redundant inverting driver. These devices can be used to control the MODE-20 line in the printer. The detailed procedures is as follows:

(a) Disconnect the lines grounding pins 12 and 13 (ENBOATA and ENBCLK, respectively) in the Z3.

(b) Connect pin 12 to pin 6 (DATA8) in the Z6 and connect pin 13 to pin 10 (WBUF) in Z1.

(c) Pin 11 in Z3 outputs data from a latch (it is equivalent to the Q terminal of a D flip-flop). Connect pin 11 to the input pin (pin 10) of the redundant driver in Z15 and connect the output pin (pin 9) of the driver to line E in the board-mounted component P1 (this provides the MODE-20 control signal).

Table I shows the connections between the printer and the interface board.

TABLE I

LPV-11 terminal	VV	C	K	NN	U	L	N
TH-2100 terminal	A ₂	A ₃	A ₄	A ₅	A ₆	A ₇	A ₈
Signal name	DATA STROBE	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6
LPV-11	R	T	LL	DD	E	A	UU
TH-2100 terminal	A ₀	A ₁₀	A ₁₂	A ₁₅	A ₂₀	B ₂	B ₁₉
Signal name	DATA7	DATA8	READY	ERR	MODE	GND	GND

Once these connections have been made, no modifications to the operating system are necessary--the printer will output ASCII characters unless otherwise instructed by the user software, which controls the output of Chinese characters.

When Chinese character output is desired, one sets bit 8 of the output data to 1 and sends bits 0-7 to the interface board (this is very easily done since the PDP11/23 processor has 16 bits). This will cause the MODE-20 line to go low and put the printer into the Chinese character mode. If bit 8 is zero, the printer is in the ASCII or Japanese kana mode. This thus provides a way of intermixing Chinese characters with other forms of output (e.g., English words, symbols, etc.).

Because the printhead does not have to wait for data received from two terminals while printing out payrolls, it can print out at top speed.

The Chinese language printer can easily be incorporated into an operating system by modifying the printer control software that comes with the system. We have developed an easy-to-use printer control program which skillfully coordinates the printing of Chinese characters and ordinary symbols.

12617
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APPLIED SCIENCES

DATA ENCRYPTION FOR CHINESE LANGUAGE COMPUTERS

Beijing WEI JISUANJI YINGYONG [MICROCOMPUTER APPLICATIONS] in Chinese
No 4, Nov 84 pp 13-18

[Article by Meng Xianpeng [1322 2009 7720], Institute of Acoustical Research, Chinese Academy of Sciences]

[Text] I. Introduction

The problem of data security in computer systems has attracted the interest of specialists and scholars since the early 1960's. With the rapid development of computer networking and the formation of databases, this problem has become more urgent and acute. In addition to being a matter of concern to numerous users, governmental agencies in various countries have also recognized the importance of data security. In June 1981, the United States Department of Defense established a special Computer Security Center to assess the security and range of applications of business computer systems.

Communications satellites and telephone lines can link national computer centers, business office computers, and even personal computers together into networks. Unless effective measures are taken to guarantee the integrity of data, it will be difficult to prevent data from being stolen or destroyed, or to prevent people from using the data for criminal activities.

Computers are must now beginning to be used in China in government administration and in the mining industry; better results will thus be achieved with less effort if we strive now to solve the problems of data security before extensive Chinese-language databases come into existence.

There are three possible ways to steal or destroy data in computer systems.

1. Unauthorized users can steal or destroy data residing in the computer system.
2. Unauthorized users can intercept data during transmission along communication lines in computer networks.
3. System managers may steal computer data.

Many methods are currently available for protecting data [1,2]. However, most of them are concerned with preventing data theft or destruction by users; less attention is given to preventing illegal tampering by systems managers. We will discuss several techniques for protecting data in what follows.

1. Use of Passwords

In this method, each file is protected by assigning a password to it which each user must know in order to access the file.

2. Access Control Matrices and Tables

In essence, access control matrices and access control tables provide security by specifying who can use the user-created files and the manner in which the files can be accessed (read-only, read-write, erase, ...). These matrices or tables are provided with the system. Whenever a user wants to access certain data, the system must use the access control matrix or table to verify if permission is granted.

3. Accounting Method

In this case access to data is controlled by providing each user with an accounting program; if another user wants to access another user's files, he must know the account number.

4. Limit Access to Terminals

In this scheme, certain types of data resources are protected by restricting the data that can be sent to certain terminals in time-sharing environments; the use of data can also be restricted by hardware, if necessary.

There are also many other methods, which we will not discuss here individually. All of the data protection schemes described above simply involve ways to restricting access to data--since no measures are taken to encrypt the data, these schemes are ineffective against systems operators, although they may provide a measure of protection against users. Data encryption has been suggested as a way to solve this problem [1]. In essence, this method involves mixing up the original data using random numbers.

The techniques mentioned in this paper are primarily concerned with encrypting data in computer networks and preventing possible abuses by system managers. All of these methods encrypt the data so that managers who obtain the encrypted data from a shared magnetic disk (or eavesdroppers who get the data from computer network lines) will have great difficulty in decoding it, because they do not know how to break the code (the encryption method and key).

II. Methods for Protecting Data

The basic ideas which we propose in this paper for protecting Chinese-language data are:

1. Treat the original data as a variable, feed it to an encryption function, and store the resulting encrypted data on a storage medium.
2. Use some algorithm to rearrange the sequential order of the original data.
3. Provide users with partial information about the keys used in the encryption process, but eliminate all traces of this information from the data and the data processing programs.
4. Let authorized users change the keys (the values of the control parameters) from time to time. According to the GB2312-80 national standards, each Chinese character is represented by two bytes, so that each Chinese character clearly takes up two bytes of storage space. Although the byte is the smallest processing unit in the GB2312-80 standards, the two bytes of each Chinese character lend themselves to convenient storage as a single word in computers with a 16-bit word-length, and the encoding can be carried out using either bytes or words as the basic unit.

The logical record is usually the smallest storage unit in file management systems (the minimum storage unit may be as small as a single item in databases). One can use either items or records as the basic units and achieve data security by scrambling the sequence of Chinese characters within items or records. The methods described below were implemented on a PDP11/23 minicomputer.

1. Permutation of the Bytes Representing Chinese Characters.

This scheme protects the data by employing an algorithm to scramble the middle bits in the two original bytes used to represent each Chinese character. This can be done, e.g., by using a shift instruction as illustrated below for the Chinese character "li", which is represented by the code

X1000001	X0100110
first byte	second byte

Now suppose we apply a left shift by one bit, and assume that the leading bit in the byte to the right of the second byte is a 0; then we get the result

10000001X	01001100
first byte	second byte

These two bytes clearly no longer represent the word "li," so that the character has been encrypted. Different encryption schemes can be devised by changing the scrambling rules.

Of course, one could also employ instructions for manipulating whole bytes and encrypt the data by changing the first or the second byte separately, thereby altering the positions of the middle bits.

This method imposes a high performance overhead when implemented in a high-level programming language but becomes more economical in assembly language, particularly for the PDP11 series of computers. It should be noted that processing in terms of bytes rather than words gives better results.

2. Encryption Functions

In this scheme one seeks a sequence of multivariate scalar-valued functions F_1, F_2, \dots, F_n which take values small enough to be represented by at most one or two bytes. This makes it possible to treat each representation of the Chinese characters (whether regarded as two bytes or as a single 16-bit word) as an argument of the function F and use the resulting value as the encrypted representation. For example, if

$$CWCC = F_n(CWC, P_1, P_2, \dots, P_n)$$

then CWCC gives the desired code for the Chinese character. (Here CWC represents the two bytes corresponding to the Chinese character; P_1, P_2, \dots, P_n are the control parameters and may be either variables or functions; F is a multivariate scalar-valued function taking values between -32768 and +32767 for a computer with a 16-bit wordlength.

One shows readily that this method can be used for continuous code conversion if the code-conversion functions F and control parameters P are carefully chosen. Good data security can be achieved if users are told some or all of the control parameters and the latter are frequently changed by authorized personnel. Thus even if unauthorized users illegally discover what the encrypting function is, they will be unable to decipher the code because they do not have access to the control parameters.

It should be noted that the existing systems featuring Western and oriental language compatibility frequently employ a "1" in the eighth bit position in each of the two bytes in order to represent Chinese characters. The two bytes representing Chinese characters thus correspond to negative values in machines with a 16-bit wordlength, and this fact must be taken into consideration when specifying the encrypting function. This method is very convenient on computers with a 16-bit wordlength, whether or not it is implemented in assembly or high-level programming languages.

3. Permuting the Bytes in a Data Item

This scheme is similar to the one which rearranges the middle bits of the two bytes representing Chinese characters. One can also use appropriate algorithms to scramble the original order of the bytes representing Chinese characters contained in a data item and store the rearranged result on a storage medium. The rearrangement can be carried out using either words or bytes as the basic units. For example, Table I shows the bytes representing the three Chinese characters "sheng xue suo" (institute of acoustics). If bytes are the basic units, the rearrangement gives $P_3 - 1 = 3! - 1 = 5$ different data items, namely:

121, 47, 113, 171, 111, 171 (xue suo sheng)
113, 171, 111, 171, 121, 47 (suo sheng xue)
121, 47, 111, 171, 113, 171 (xue sheng suo)
113, 171, 121, 47, 111, 171 (suo xue sheng)
111, 171, 113, 171, 121, 47 (sheng suo xue)

These new permutations are clearly obtained simply by rescrabbling the byte order; the bytes themselves are not changed. Consequently, it is very easy to decipher the message if the data item contains only a few bytes. Better data scrambling can be achieved by permuting the byte order while at the same time reshuffling bytes among adjacent words. For example, let the data item contain the three Chinese characters for "sheng xue suo"; then the storage medium contains the byte sequence

111, 171, 121, 47, 113, 171
sheng xue suo

We can get several results by permuting these bytes, one of which is

111, 47, 113, 171, 121, 171
shang suo yang

This encryption method is clearly much more effective than simply permuting the words themselves; although expensive in terms of computer resources, it is often feasible.

The permutation method is easily implemented either in assembly language or in a high-level programming language. Because items are usually the smallest units that can be accessed in database systems, scrambling of items is better suited for such applications.

TABLE I. The Six Bytes Representing the Phrase "Sheng Xue Suo"
(all numbers are expressed in octal)

<u>Character</u>	<u>First Byte</u>	<u>Second Byte</u>
Sheng	111	171
Xue	121	47
Suo	113	171

4. Byte Permutations in Records

This scheme is essentially identical to the item-by-item scrambling method. The only difference is that the latter permutes all the bytes representing Chinese characters within an item, while the former scrambles all bytes within a logical record. Since logical records contain many more bytes than items do, the number of possible permutations $P = n!$ is clearly much greater, so that deciphering will be difficult even if only words are scrambled. Because of its specific advantages, however, bytewise scrambling is usually favored in practice.

5. Combining Encryption Functions with Permutations

We have already discussed the essential ideas and methods for providing data security in the four techniques described above. In order to improve security, the encryption function and the permutation methods can be combined. The combined method may first use the encryption function to alter the form of the data and then permute the results, or the data may be scrambled first and then input to the encryption function. As we have mentioned above, one can choose words or bytes as the smallest units to be processed whether by the permutation or the encryption function methods, and data items or whole logical records can be encrypted. These combined methods may be remarkably successful in ensuring that the data cannot be deciphered.

Our interest in this paper can be confined to encryption methods; in practice of course, suitable methods for deciphering the data must also be available. We will not dwell on this topic here, but merely note that decoding is very easy if the encryption method is known.

III. Design of Programs for Data Security

No matter how the above protection schemes are implemented, the strategies and techniques employed by the software engineer will depend on the special characteristics of the operating system and on its data security requirements. We will not go into these matters here but will merely mention a few points which we have learned from practical experience.

1. Modularization of Encrypting and Decoding Software

There are at least two advantages to modularizing the software used to encrypt and decipher data:

- (a) It is easier to make changes. Once user software systems have been installed, new user requirements or the availability of a new data security method require updating the data protection methods. If the software is modularized, only the relevant modules will need to be modified.
- (b) Modularized software is easier to debug.

2. Choice of the Encryption Method

The following points should be kept in mind when selecting encryption methods:

- (a) The above methods do not impose equal demands on the systems--the overhead is generally somewhat greater for methods which provide better security. One must therefore consider the overall requirements of the system and not simply seek to maximize security alone.
- (b) Some methods are better suited for file management systems, while others are best for databases.
- (c) The above discussion of data security methods assumes a micro-computer with a 16-bit wordlength (or a small to mid-sized computer). The principles discussed above can be used to decide which method is most effective for 8-bit computers or for computers with wordsizes exceeding 16 bits.

3. File Protection

The above methods have been discussed from the viewpoint of data protection through encryption. This will of course also have implications for the protection of files. However, any security scheme must also include provisions for deciding who is permitted to access a file and in what form (read-only, read-write, etc.). Some of the methods mentioned in the Introduction and discussed in Refs. [1, 2] can be used here. It is worthwhile pointing out that in the password method, data security can be greatly improved if the password itself is used in the encryption process.

4. Data Integrity

The methods described in Ref. [2] are generally employed to ensure data integrity. However, we should point out that "false failures" may occur in some of the methods introduced in this paper. By a "false failure" we mean a situation when someone has forgotten or lost the "control parameters," so that data cannot be accessed even though they are stored normally within the computer system. The following two methods can be used to solve this problem.

(a) Make backup copies on media that can be removed from the system (e.g., floppy disks). The data in the backup should either be unencrypted, or else the encryption should be done using "control parameters" which are permanent and easily remembered. In this way, the data can be recovered regardless of whether an actual or a "false" failure has occurred. The backup should be entrusted only to authorized users.

(b) If many users share the same data and someone forgets the "control parameters," there are no serious consequences because the parameters can be obtained from the other users.

5. Protection of Shared Data

The above methods all use the concept of "control parameters." If several users are to share the same data, these parameters must be made known. In this case, however, the control parameters must be changed frequently in order to make the data more secure. The new values should promptly be made known to all users authorized to access the data.

IV. Examples

We will briefly discuss the implementation of security measures used by a Chinese-language file management system based on the PDP11/23 minicomputer.

(a) File access is limited through the use of passwords; these passwords are used in the encryption process and are stored in the data files. Thus even systems programmers would have a difficult time identifying the password corresponding to a given file.

(b) The encryption function and permutation methods are combined to encrypt file data completely. The encryption function depends on six arguments:

$$CWCC = F_m(CWC, R_n, P_1, P_2, P_3, P_4)$$

where the four variable control parameters P_1, P_2, P_3, P_4 are known to the users and R_n is a random function whose values depend on P_1, P_2, P_3, P_4 . CWC is one byte of a Chinese character and is represented by an integer; $CWCC$ is thus also an integer, and its value ranges from -32768 to +32767.

After each Chinese character has been encoded by the encryption function F_m , the words in each file are permuted.

2. Designing for Program Security

- (a) The operating kernel contains a "password" module for controlling access to files.
- (b) An encrypting and deciphering module handles all of the data encoding and decoding requirements.

V. Conclusions

We have barely scratched the surface in our above discussion of methods for providing data security. As computers become more common in China (particularly with the spread of Chinese-language databases used in government administration of the mining industry), better methods will be needed for improved data security. Such security measures may become an important criterion for judging the quality of home-produced operating systems and database and file management systems.

We thank Wang Mengyang [3769 1125 7122] for assisting us in this work.

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CSO: 4008/269

APPLIED SCIENCES

ANHUI PROMOTES COMPUTER TECHNOLOGY

Beijing GONGREN RIBAO in Chinese 17 Jan 84 p 2

/Article by Wang Qinghua /3769 3237 5478/, vice chairman of the Anhui Provincial Economic Commission/

/Excerpts/ Early in 1976, the Anhui Provincial Research Institute of Electronics developed China's first DJS050 microcomptuer. It was approved by the Headquarters of State Bureau of Computers and put into small-scale production. The computer was awarded a prize at the All-China Congress on Sciences and Technology. Another microcomputer, the DJS-051, was designed in 1978 with the cooperation of the Shanghai Radio Plant No 14 and was awarded the Shanghai Municipal Prize for major achievement in science and technology. In 1980, the DJS-052 microcomputer was developed and awarded the Anhui Provincial prize for achievement in science and technology. In addition to its research and prototyping activiites, Anhui has since 1979 been promoting the general application of microcomputers. Several large-scale inquiries were made into this question by the provincial economics council, the science council, and the Ministry of Electronics Industry, and a policy promoting the use of microcomputers was drafted. In 1981 a ranking official of the China National Economics Council visited Anhui to examine the work in progress and expressed great interest in the newly developed DJS-052 microcomputer equipment, which he suggested might be employed for business management applications. Backed by the support and serious attitude of the Anhui councils and responsible provincial officials, we then carried out field testing, first at the Anhui Printing and Dyeing Mill and later at the Anhui Textile Mill No 1, the Anhui National Celebration Textile Mill, and other locations. In these tests the computers were used to keep inventory and to control the mechanized production process, and in all cases the results were outstanding. The Ma Steel Company has been using a computer to manage its production and finances and is now able to predict the future profit of the entire company; the computer has been instrumental in improving the economic effectiveness of the company. The successful experience of factories, mines, and other enterprises has encouraged us to use computers to control production and process economic data. Beginning in 1982, during the preparations for the Anhui Economic Congress, computer methods were introduced to regulate Anhui's electric power grid in order to manage the economy and provide timely, accurate, and reliable control of working and production conditions throughout the province. Another goal was to gradually increase the use of computer-generated data in reaching economic

decisions and benefit from the more rapid exchange of data. In April 1982, specialists affiliated with the Anhui Science Council Organization held discussions in which computer popularization was judged to be feasible; work on implementing such a program began immediately thereafter. After more than a year of hard work, digital methods are now beginning to be employed in production control. The initial applications during the last year demonstrate that computer systems can transmit data rapidly in a form that is easy to analyze and retrieve; moreover, reports can be copied clearly and filed on time. Computer processing of production control data is much more efficient than the old manual methods. In the future, when the use of computers has become routine, computer systems will provide reliable data for economic statistics, forecasting, and planning, and the results can be used to take appropriate regulatory action. This will stimulate the modernization of economic management, promote automation, and foster a more rational use of resources.

The policy of self-reliance should be upheld; arduous pioneering work must be undertaken and new advances made. The dissemination of computer technology is a new endeavor which will inevitably encounter all types of difficulties. There may be problems with funding, equipment problems, or technical difficulties. We must find solutions based on resources available in Anhui and in China and proceed in a spirit of self-reliance. We must observe the principle of "setting high goals, starting from a low level, minimizing investment costs, and getting quick results." It is also necessary to exploit any favorable conditions relating to technical goods and materials; we should make full use of equipment that can be produced in China and employed in Anhui, do our best to keep costs down, and work hard. In this way we will advance more rapidly, there will be more leeway for development, the transition period will be less difficult, and the dissemination of computer technology will be facilitated. Centralization, unification, and a high degree of cooperation will be necessary. There are currently more than 170 large, medium, and small microcomputers in the whole of Anhui province, and this scattering of resources is wasteful. This phenomenon is probably not peculiar to Anhui but is typical of all of China. If the use of computers were centralized, progress could be speeded somewhat. The situation might be likened to a game of chess--if only everyone would adopt a farsighted strategy of trying to do whatever serves the general good and were willing to endure inconveniences and work harder, all difficulties would be quickly resolved.

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APPLIED SCIENCES

MICROCOMPUTER METHODS USED TO CONTROL FERTILIZER PRODUCTION

Beijing GONGREN RIBAO in Chinese 17 Jan 84 p 1

/Article by Qian Tengwen /6929 7506 5730/ and Li Haiqiang /2621 3189 1730/ /

/Text/ Engineer Tang Dianli /0781 0368 0536/ and his wife assistant engineer Liang Xiuyun /2733 4423 0061/ work at the Guangxi Research Institute of Chemical Engineering. With the vigorous support and guidance of the Research Institute and the active cooperation of the Yulin Prefectural Chemical Fertilizer Plant, the Tangs embarked on a bold and innovative plan which required more than a year of experimentation and 1,136 computer software debugging operations. The result has been China's first success in using microcomputers to control the hydrogen-to-nitrogen ratio in small-scale nitrogenous fertilizer production. The yield of standard-grade synthetic ammonia has increased from 54.5 percent using manual control methods to 98 percent. The consumption of electricity, raw materials as coal, and fuel have been reduced by 2.9, 5.7 and 30.5 percent, respectively.

Tang Dianli and his wife used to work at a small nitrogenous fertilizer plant in another country. They observed that the manual methods used to control the hydrogen-to-nitrogen ratio in the production of nitrogenous fertilizer resulted in both high costs and low quality. Moreover, the old methods put a strain on the workers and caused the company to operate constantly in the red. They resolved independently to reform the production process, but for various reasons were unable to get started. Then in August of 1981, after the middle-aged couple had been transferred to the Gaungxi Research Institute of Chemical Engineers, the Tangs volunteered to undertake the difficult task of experimenting with computer methods for automatically adjusting the hydrogen-to-nitrogen ratio. During the course of their studies, they devoted practically every free moment (noon breaks, evenings, and festivals and holidays) to the solution of this problem--even during mealtimes they would be busy studying their books and materials which were propped up on the table. They had to travel a distance of roughly a hundred miles from the Yulin Prefectural Chemical Fertilizer Plant to the Institute in order to perform the industrial tests. How did they manage this, with two young children and no one to look after them? Mr and Mrs Tang decided to use their savings to buy some meal tickets and informed their neighbors when they would be away. Then they would set off directly for the experimental plant and remain there for as long as several months. Their selfless contribution has yielded gratifying results--on 25 November of last year, their research results were examined by the relevant national ministries and technically approved.

APPLIED SCIENCES

ZHEJIANG'S FIRST COMPUTERIZED TELEGRAPH DISPATCHER

Hangzhou ZHEJIANG RIBAO in Chinese 23 Dec 83 p 1

/Article by Dong Guanju /5516 7070 1565/ /

/Text/ On 22 December 1983, at 7:00 pm, the heart of Zhejiang's telecommunications system--Hangzhou's 64-line automatic remote-controlled telegraph dispatcher--was put into operation after more than a month of tests and circuit simulations. The tests revealed failure-free operation, and the system was approved by the Ministry of Posts and Telecommunications.

On an average day, the Hangzhou Ministry of Telecommunications dispatches more than 60,000 telegrams, of which more than 90 percent are nonlocal and directed to all parts of China. The work load was already heavy, but to make matters worse, the previous year saw a sharp increase in the amount of telegraph traffic, and prompt and accurate service could not be assured. In order to free itself from this predicament, the Hangzhou Ministry of Telecommunications, under the guidance of the Ministry of Posts and Telecommunications and the Zhejiang Administrative Office of Posts and Telecommunications, and with the direct assistance of the Shanghai Municipal Telegraph Office, has installed a computerized automatic remote-controlled telegraph dispatching system to replace telegraph switchboard operators and greatly improve efficiency. Formerly, the telegraph department of the Ministry of Telecommunications was understaffed by more than 60 people according to the quotas established by "mutual consent" and issued by the ministry. With the new system now in place, it will be unnecessary to increase the number of telegraph personnel for another 2 or 3 years. In the past, a telegram could be sent to a subscriber only by routing it indirectly through several telegraph offices. For example, in order for someone in Leqing county to send a telegram to Beijing, the telegram had to be routed through Hangzhou before it could reach Beijing. Once at the Beijing central dispatching office, the telegram had to go through some 10 different procedures, requiring from 25 to 35 minutes altogether, before it could be sent out. Now, however, only 2 or 3 minutes are needed to dispatch a telegram directly to Beijing. In addition to speeding up transmission the new system also reduces errors.

The 64-line, automatic remote-controlled telegraph dispatching system employs a small readily available Chinese-produced computer and is equipped with highly efficient system software. The system accepts and stores all types of telegrams.

regardless of the circuit along with which the telegrams are transmitted, and accurately lists the arrival times and the current telegram number, automatically identifies and sorts different classes of telegrams (weather bulletins, army and government telegrams, alerts, and the four categories of general telegrams) and assigns priorities in order of urgency. The system can also automatically send a telegram to the same destination as an earlier telegram and systematically determine the order and direction (incoming or outgoing) of dispatches. An automatic warning is issued if an error has been detected, and the system can terminate dispatching if necessary. Since the system is also equipped with interactive man-machine facilities, it can accurately respond to all types of telegraphic "commands," so that rapid dispatching is facilitated.

In addition to greatly speeding up long-distance communications in Zhejiang province required by industry and agriculture (and by ordinary citizens), the automated telegraph dispatcher will play an important role in national economic development through the province.

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APPLIED SCIENCES

MICROCOMPUTER-CONTROLLED CLOSED-LOOP SYSTEM FOR POSITIONING RADIO TELESCOPE

Beijing WEI JISUANJI YINGYONG [MICROCOMPUTER APPLICATIONS] in Chinese No 4, Nov 84 pp 26-30

[Article by Zhu Liqing [2612 4539 0615], Chu Yingyi [0443 3841 0308] and Zhang Zhenchao [7022 2182 6389]; Nanjing Astronomical Instrument Plant, Chinese Academy of Sciences]

[Text] The Nanjing Astronomical Instrument Plant manufactures a millimeter-range radio telescope of diameter 13.7 m which resembles a radar station and is used to track and observe stars that emit radiation at radio frequencies. The horizontal system responsible for moving the principal receiving plane is equipped with servo systems for controlling the azimuthal position and pitch of the telescope. The system moving the auxiliary plane has four degrees of freedom, each of which is controlled by a servo system. Altogether, the telescope contains six servos which employ closed-loop computer-controlled positioners for automatic tracking and focusing. During operation, the telescope system is first positioned approximately using predetermined parameters of the star under observation, after which tracking proceeds using azimuthal and pitch coordinates calculated in real-time by the computer.

In order to match the servo systems to the basic requirements of the closed-loop computer positioning system, we designed and tested a microprocessor-based controller in experiments on the control of servo systems for regulating the principal and auxiliary planes of the telescope, and we studied methods for coordinating and correcting the system. We will briefly describe this work.

I. Basic Design Requirements

1. The system is controlled by a Cromemco Z80 microprocessor.
2. The TU-ART interface board provided for the Z80 processor is used as the data input/output (I/O) interface.
3. In order to implement the closed-loop control, the software must perform the following tasks:

- (a) automatically generate the control function $A_1(t)$, i.e., the value used to control the servo system;
- (b) sample the feedback values $A_2(t)$, which correspond to the actual position of the telescope;
- (c) calculate the difference $\Delta A = A_1 - A_2$;
- (d) interpret and adjust the difference ΔA ;
- (e) precorrect ΔA ;
- (f) use the ΔA output to control the system.

4. It was necessary to design a suitable external circuit to interface the TU-ART board with the servo system.

Guided by the above requirements, we may summarize the procedure for designing the microprocessor-controlled closed-loop positioning system as follows. The Z80 processor automatically generates the values $A_1(t)$ used to regulate the servos and is also able to sample the actual position $A_2(t)$ of the system through the TU-ART interface and to use this value as feedback. The difference between A_1 and A_2 is then calculated and suitably interpreted and precorrected. Finally, the corrected difference signal is output through the TU-ART interface in order to control the servo system.

II. Brief Description of the Closed-Loop Microprocessor-Controlled System for Positioning the Principal Surface

Since the azimuthal and pitch servos are similar for the principal plane, we will discuss the main technical aspects of the azimuthal servo system.

1. The control code automatically generates a triangular control function $A_1(t)$ which consists of three 8-bit words and is used to regulate the positioning servo.

2. The position of the servo system is checked by a 23-bit inductosyn, whose value is sampled by the microcode. This value is input as three 8-bit words to the processor and is used as the feedback function $A_2(t)$.

3. The microprocessor subtracts the 23-bit values $A_1(t)$ and $A_2(t)$ using multibyte arithmetic to form the difference $\Delta A = A_1(t) - A_2(t)$, which is also three bytes long. The microcode then transforms this difference into a signed 12-bit value to prepare it for output to the analogelectronics of the servo system via a DAC-HZ12DMR 12-bit D/A converter. To this end we employ the "saturation" method to process the difference, i.e., if the absolute value of a number is too large to fit into 11 bits, the microcode replaces it by the largest possible 11-bit value (equal to 2047).

4. Table I shows the input/output relations for the DAC-HZ12DMR converter, i.e., the rules for converting bipolar digital signals into the signal levels used by the analog circuit, for a specified reference voltage. When we wrote the microcode we used uncomplemented code to represent the difference value obtained by subtraction. Before sending this 12-bit numerical code to the D/A converter it was therefore necessary to convert it as follows: for

positive values, take the complement (without changing the sign) before outputting it; for negative values, output the original code.

Table I.

<u>D/A Input Code</u>			<u>D/A Output Voltage</u>
0000	0000	0000	+ 9.9951 or +4.9976 V
0011	1111	1111	+ 5.0000 or +2.5000 V
0111	1111	1111	0.0000 V
1011	1111	1111	- 5.0000 or -2.5000 V
1111	1111	1110	- 9.9951 or -4.9976 V
1111	1111	1111	-10.0000 or -5.0000 V

5. The microprocessor precorrects the difference signal and outputs the processed difference ΔA to the D/A converter, where it is converted and then input to the analog circuits of the servo system. In order to ensure stable operation with good dynamic response, precorrection can be performed internally by the microprocessor, after which the corrected signal $\Delta A(t)$ is output to control the servo system. Here we replace the original step signal ΔA at the output by an aperiodic sequence of step segments as shown in Figure 1, where the original and corrected signals are indicated by ΔA and $\Delta A(T)$, respectively. The properties of the system depend on the conversion time constant τ , and we see that some of the system characteristics can be improved by suitably selecting τ .

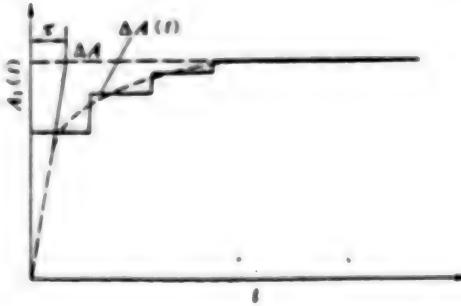


Figure 1. Form of the precorrected signal $\Delta A(t)$ at the output.

6. Figure 2 shows a flowchart of the sequence of microcode operations used to control the principal plane.

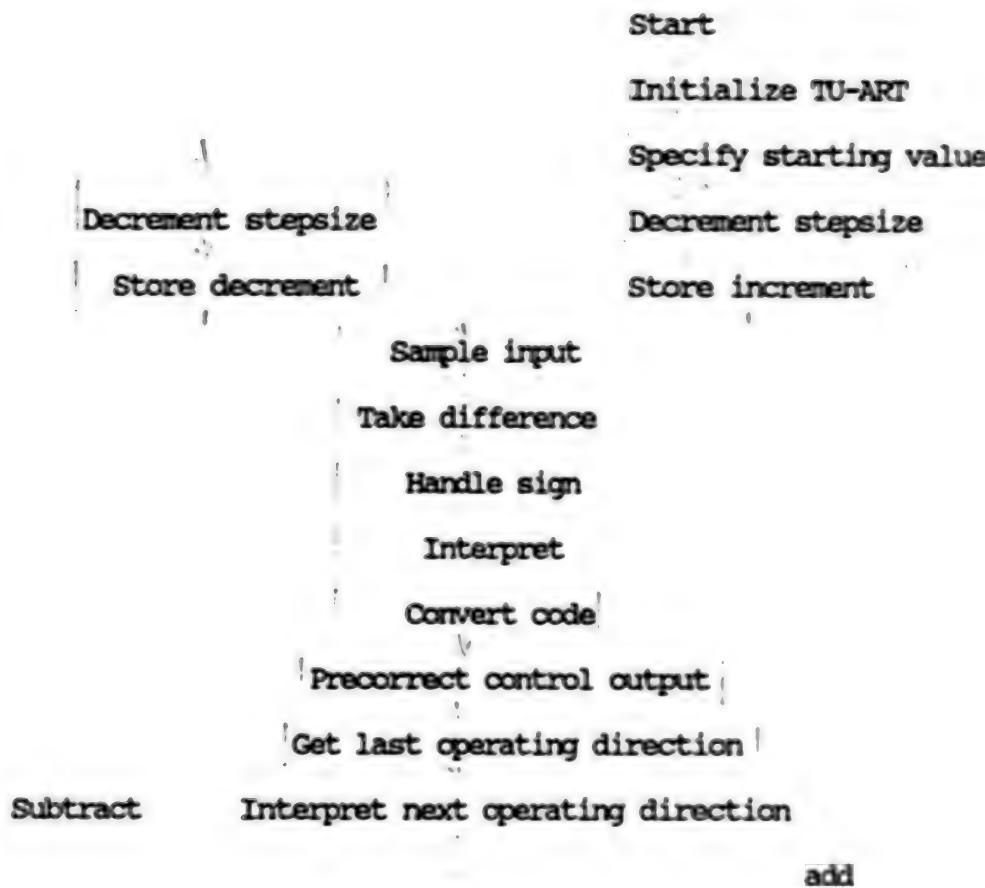


Figure 2. Flow chart showing the control program for the principal plane control system.

7. The hardware used in the microprocessor-controlled servo system is configured as follows.

(a) The closed-loop servo system for positioning the principal plane is controlled by a Z80 microprocessor and uses the parallel I/O port of the TU-ART board for input and output. The TU-ART is a programmable, highly functional two-directional universal asynchronous receiver/transmitter which is equipped with two bidirectional serial and two parallel interfaces for exchanging data. We used the parallel interface in our application. The first step was to suitably configure the 10 DIP switches on the board. Switches 3-6 and 7-10 were set to correspond to the base addresses for ports A and B, respectively; switch 1 was the interrupt select switch, while switch 2 determined whether or not the software addresses were inverted. The next step was to have the user program initialize the TU-ART; this was done by storing the instruction words required by the user system in the TU-ART so as to match the data input/output to the design requirements of the user device.

(b) The interface for sampling and inputting the 23-bit feedback value was designed as follows. The TU-ART parallel port has an 8-bit word size, so that an external interface is needed to sample and input the 23-bit words. This circuit sends the 23-bit binary signal from the inductosyn to a buffer consisting of three 3-state gates which transmit the high, middle, and low words of the feedback signal respectively. The design of the external interface includes a counting and code-translating circuit, which receives the sampling control pulse from the TU-ART, samples the feedback signal three times by opening one of the three 3-state gates according to a specified sequence, and then inputs the results in sequence to the micro-processor. Figure 3 shows a block diagram of the circuit.

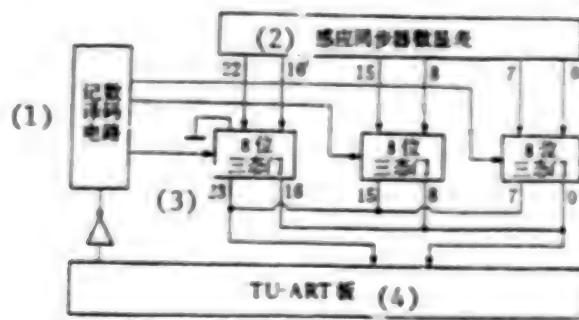


Figure 3. Interface for sampling and inputting the 23-bit feedback value.

KEY: (1) Storage and translation circuit
 (2) digital display of inductosyn
 (3) 8-bit 3-state gate
 (4) TU-ART board

(c) Another interface is needed to serve as an output register for the 12-bit control value. This circuit employs two 8-bit D/A converters for a total conversion wordlength of 16 bits (the highest four bits are not used). The TU-ART routes the high and low 8 bits of each control value to two separate output ports, where they are sent to the external interface circuit and fed successively to one of the two 8D flip-flops (this ensures the integrity of the 8 high and 8 lowbits). The signals output by the 8D flip-flops are sent to the D/A converters and used to control the servo system. Figure 4 shows a schematic of this circuit.

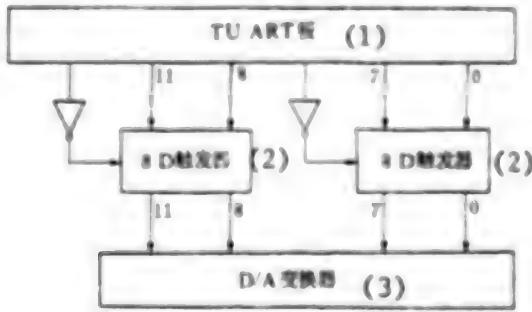


Figure 4. Twelve-bit control output interface.

KEY: (1) TU-ART board
 (2) 8 D flip-flop
 (3) D/A converter

(d) Figure 5 shows a block diagram of the servo controller employing the Z80 microprocessor (M-5).

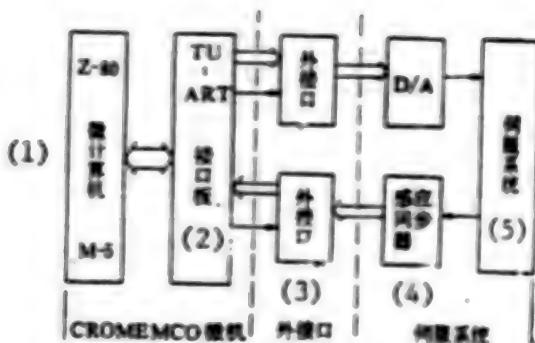


Figure 5. Block diagram of circuit employing Z80 microprocessor to control the servo system.

KEY: (1) microprocessor
 (2) interface board
 (3) external interface
 (4) inductosyn
 (5) servo system

III. Brief Description of the Servo System for the Auxiliary Plane

This system has much in common with the one for the principal plane, so we will confine ourselves to the differences.

1. There is one servo for each of the four degrees of freedom in positioning the auxiliary plane of the radio telescope; each servo has the same positioning range (excursion), which is adjustable from 0 to 1 inch. Since the four systems are similar, we will only discuss one of them in what follows. In analyzing the dynamic operation of the closed-loop system, we adopted a telescope guidance method which differed from the method used for the principal plane. In this method we divided the total excursion into 9 parts corresponding to a control function with 9 steps equal numerically to 0.111, 0.222, 0.333, ..., 0.999, as shown in Fig. 6. [See following page]

2. The servos can operate continuously only in the interactive mode with the telescope operator. That is, after the servo has reached the position corresponding to the control value output by the microprocessor during tracking, the processor interrogates the operator to determine if the motion should continue. If the response is yes, the microprocessor generates another step function to guide the continuous motion of the servo.

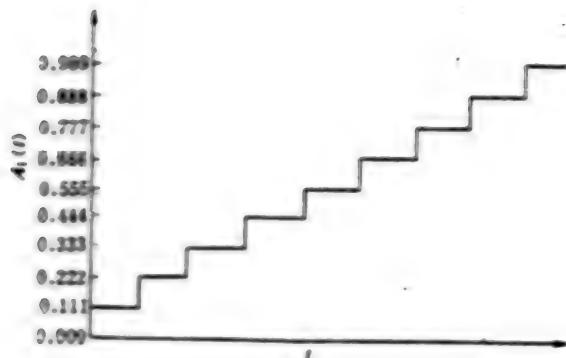


Figure 6. Control function $A_1(t)$ used by the system to position the auxiliary reflecting plane.

3. An LVDT (linear variable differential transformer) and an AD2006 digital display make up the feedback system of the auxiliary plane servo. The AD2006 display transmits and displays signals in BCD (binary coded decimal) form. In terms of bits, the BCD code length will be 3 and $\frac{1}{2}$ decimal digits if the 14-th bit is used as the sign bit. The feedback signal passes through the TU-ART board and the external interface and is fed back to the processor. Since the microcode uses binary arithmetic to perform the calculations, the code must first translate the BCD feedback values into binary format.

4. The above discussion shows that the control and feedback values for the auxiliary plane differ from those for the principal plane. In particular, they are stored in the processor as two words of data, so that in some respects the external interface circuit which samples the feedback value and outputs the control value differs from the external interface for the principal plane, while in other respects it is identical. Figure 7 shows a block diagram of the interface used to sample and input the 14-bit feedback value for the auxiliary plane; the schematic for the interface used to output the 12-bit control value for the auxiliary plane is similar to the one shown in Figure 4.

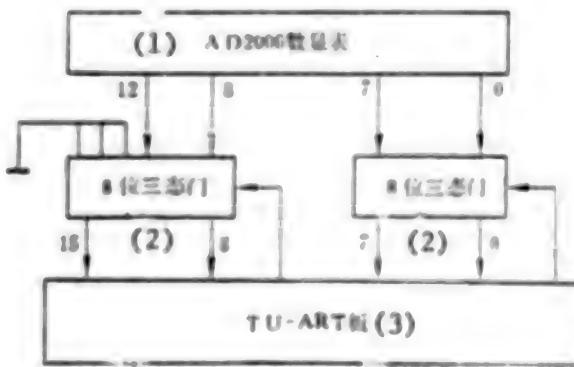


Figure 7. Diagram of 14-bit interface for sampling and inputting the feedback value.

KEY: (1) AD2006 digital display
(2) 8-bit 3-state gate
(3) TU-ART board

5. The flowchart in Figure 8 shows the sequence used to control the auxiliary plane servo. [See following page]

6. The control program for the servo system orienting the auxiliary plane is similar to the program for controlling the principal plane; for example, the closed-loop differencing, truncation ("saturation") of the difference value, precorrection method, code conversion, and output control are all the same. We will therefore not dwell on these details here.

IV. More on the Design and Testing Process

1. We used the Z80 assembler language to develop and organize the control program, which was edited, assembled, and linked on an M-5 microprocessor. The analog system was then put into operation using the TU-ART board and external interface circuit. The operation of the program and interface was monitored and the system was debugged during continuous operation.

2. We verified that the sampling input and control output were operating normally by recording oscilloscope traces of the control pulses at the difference (ΔA) output and of the input control pulses, which were sampled by the processor via the TU-ART. We also used the DEBUG program to plant breakpoints in the code; this enabled us to trace the data transfer and conversion processes and verify that both the software and hardware were operating normally.

3. The reader may consult Ref. 1 for more information on aspects of the design and testing process which we have not discussed in this paper. Our design allows for the effects of the sampling period on the precision of the system and on its dynamic performance; the sampling frequency exceeds 10 Hertz for the system described above (sampling period < 100 milliseconds). In addition, the "zero step" holding principle of digital control was employed.

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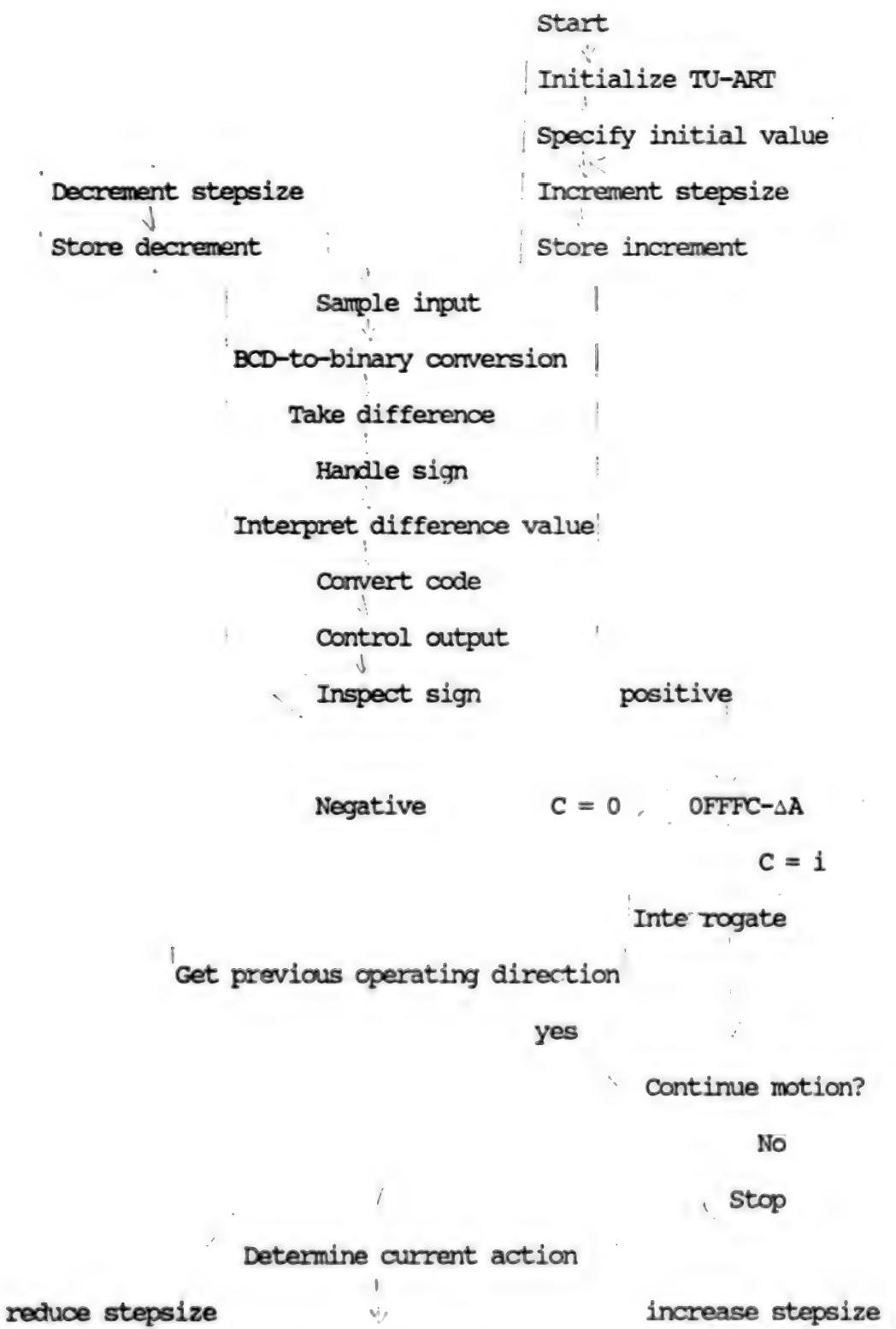


Figure 8. Flow chart of control program for the auxiliary plane servo system.

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APPLIED SCIENCES

LASER ANEMOMETER USING A SINGLE CIRCUIT BOARD

Beijing WEIJISUANJI YINGYONG [MICROCOMPUTER APPLICATIONS] in Chinese No 4, Nov 84 pp 48-51

[Article by Gu Weiyu [7357 1983 3254], Han Shouchun [7281 1343 2504], Song Zhengfang [1345 2973 2455], Liu Xiaochun [0491 2556 2504], Ding Qiang [0002 1730] and Qi Fudi [2058 5958 1717], Anhui Optical Machinery Institute, Chinese Academy of Sciences]

[Text] Real-time measurements of average wind velocities over ranges of a few hundred meters or more are important for the national economy and in scientific research; nevertheless, effective and economical measurement methods remain unavailable. We have designed a laser correlation anemometer which exploits the relationship between fluorescence induced by a laser beam traveling in air and the wind velocity in the path of the beam. The system measures the average vertical wind velocity in the path of the laser beam and employs a DBJ-80 single-board computer; it makes full use of software capabilities and does not require modulus conversion systems. The device is light-weight and easily transported, and tests show that accuracy of the measurements is highly satisfactory.

I. Principles of Wind Measurement

By means of an appropriate mathematical analysis, one can use the theory of laser beam propagation in air to derive an accurate quantitative formula which relates the wind velocity to the statistics of laser beam propagation. Let P be the distance between two observation points at the same altitude in the receiving plane; then if the ratio $P/\sqrt{\lambda L}$ is equal to 0.3075,

where $\sqrt{\lambda L}$ is the Fresnel scale length, the vertical wind velocity v in the path of the beam is given by

$$v = k \cdot E.$$

Here $E = \nabla B_I$ is the gradient of the spatial covariance B_I (normalized to unity) of the time delay of the laser beam intensity I (the gradient is evaluated at the instant of zero delay) the proportionality factor $k = 0.328$ $k = 0.328 \sqrt{\lambda L}$, where L is the pathlength of the laser beam in air and λ is

the wavelength of the laser light. By definition, the normalized covariance of the laser intensity is given by

$$B_1(\rho) = \langle (I(\vec{p}_1) - \langle I \rangle) (I(\vec{p}_2) - \langle I \rangle) \rangle / \langle (I - \langle I \rangle)^2 \rangle$$

Here $\rho = |\vec{p}_1 - \vec{p}_2|$, where \vec{p}_1 and \vec{p}_2 are the position vectors of two observation points on the receiving plane. The angle brackets denote ensemble averages; the time averaging can be carried out in real-time during the measurements. If the above equation is used to calculate the covariance whose gradient E is required, the wind-measuring device must be equipped with a two-channel modulus converter and a microcomputer system with a large amount of internal memory.

We used the formula

$$B_1 = -\cos \left(\frac{n^+}{n} \cdot \pi \right)$$

to approximate the normalized covariance of the laser intensity I in terms of the relative polarities (signs) of the signals. This approximation is valid if n , the number of points sampled, is sufficiently large. Here n^+ is the number of measurements which are greater than the respective average values for the two channels (i.e., positive), where each channel is sampled the same number of times. In order to calculate the normalized covariance it thus suffices to count the number of times the sampled signal is positive or negative relative to the average value--the specific numerical value of the signals is not required. This makes it possible to replace the data acquisition system by simple two-element output circuits and general-purpose interface chips in which only two bits are required; moreover, each sampling requires only one bit, or just one-eighth the RAM resources that would be needed by a modulus conversion system working with 8-bit words. One can thus design a laser anemometer using a DBJ-80 single-board computer.

II. Hardware

The laser correlation anemometer is equipped with a 2mW single-mode helium-neon laser which generates the light signal; the receiver contains two prisms which are separated by an adjustable distance, which is selected equal to $0.3075 \frac{\lambda}{\lambda} L$ during operation. The prisms split the light beam into two parts; the size of these beams is determined by the diameter of films plated on the lenses (the films enhance reflectivity of the lenses and limit the field of observation). The light signal is monitored by a photodiode, and each of the light signals output in the two channels is preamplified and then split into two subbeams. The reference voltage of the comparator is equal to the average value of the signal after passage through the averaging devices; the comparator outputs a "1" if the instantaneous signal amplitude exceeds the average value and outputs a "0" otherwise. The outputs of the two comparators are connected to pins PB₇, PB₆ of port B in the μ P8255A, respectively, and are sampled and analyzed by the DBJ-80 single-board computer. The DBJ-80 has 4K or EPROM and 2K or FAM; the EPROM

stores the program used for the wind measurements, as well as the microcode controlling the DBJ-80; the observation data are stored in RAM. Figure 1 shows a block diagram of the system.

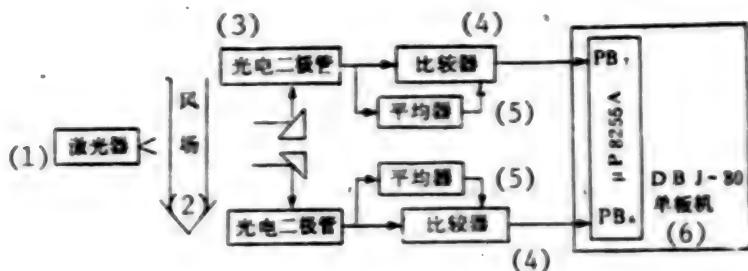


Figure 1. Block diagram of the system.

KEY: (1) laser
 (2) wind flow
 (3) photodiode
 (4) comparator
 (5) averaging device
 (6) DBJ-80 single-board computer

III. Application Program

The main program of the laser correlation anemometer contains initialization, data acquisition, data processing, and printout routines. After operation has started, the operator inputs the necessary operating parameters from a keyboard (these parameters include the pathlength L, sampling rate, the total time during which the wind speed is to be measured, etc). The device will then operate continuously without any need for human intervention, except when the operating conditions must be changed. The measured results are output by a VOESA1871 pocket-sized printer or displayed on a numerical-readout tube.

1. Data Acquisition Subprogram

Port B of the μ P8255A is designated as the input port during the initialization process. The task of the data acquisition subprogram is to input one bit from each of PB_7 , PB_6 in the proper order, in accordance with the sampling rate and time delay specified during the initialization, and to store these bits in RAM at a rate which matches the data acquisition rate specified during the initialization. The delay program is used to control the sampling rate, which is generally at least 1 kHz, and at least 5K data points are measured. Figure 3 shows a flowchart.

2. Data Processing Subprogram

The corresponding bits of the sampled values from the two channels are compared, and the number of positive events n_1^+ is counted for equal numbers

of the respective bits; the leading bit of the data in the first channel is removed, and n_2^+ is determined by a multiple forward process. The wind velocity is then calculated from the formula

$$v = [\cos(\pi \cdot n_2^+ / (n-1)) - \cos(\pi \cdot n_1^+ / n)] \cdot k / T$$

where $k = 0.328 \sqrt{\lambda L}$, T is the sampling period, and n is the number of points sampled. The flow charts for these calculations are shown in Figures 4 and 5.

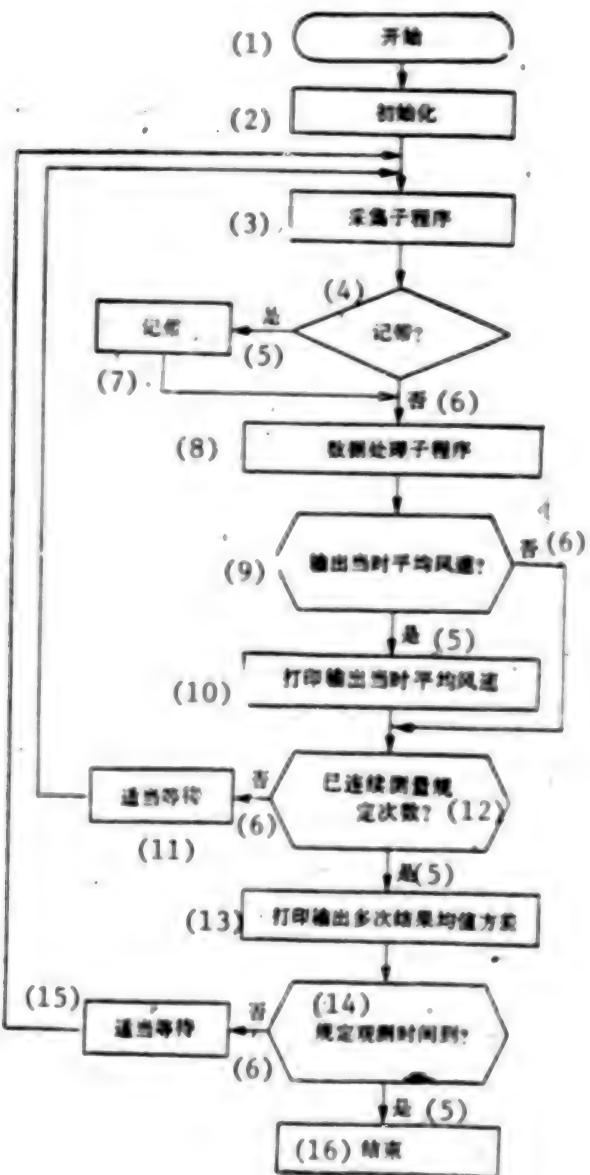


Figure 2. Flow chart for main program

KEY: (1) Start
 (2) Initialize

- (3) Data acquisition subroutine
- (4) Store on tape?
- (5) Yes
- (6) No
- (7) Store on tape
- (8) Data processing subroutine
- (9) Output current average wind velocity?
- (10) Print current average wind velocity
- (11) Appropriate wait period
- (12) Has the specified number of continuous measurements been made?
- (13) Print out the results (average, variance) of the repeated measurements
- (14) Specified measurement time over?
- (15) Appropriate wait
- (16) Stop

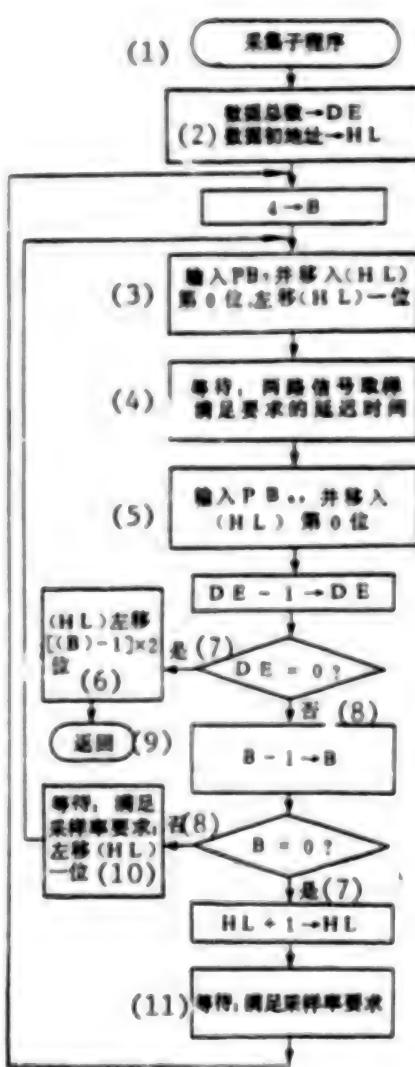


Figure 3. Flow chart for data acquisition subprogram

KEY: (1) Data acquisition subprogram
 (2) total number of data points \rightarrow DE, initial data address \rightarrow HL
 (3) input bit 0 of the parallel input shift register (HL) in input PB₇, shift (HL) one bit to the left;
 (4) Wait loop (its purpose is to ensure the required sampling delay for the signals in the two channels)
 (5) Input PB₆, input bit 0 from parallel shift register (HL)
 (6) Shift (HL) 2(B - 1) bits to the left
 (7) Yes
 (8) No
 (9) Return
 (10) Wait to ensure sampling rate; shift (HL) one bit to the left
 (11) Wait to ensure required sampling rate.

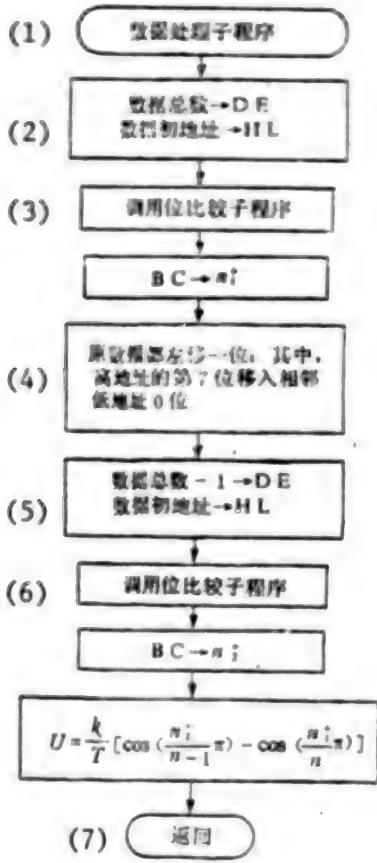


Figure 4. Flow chart for data processing subprogram.

KEY: (1) Data processing subprogram
 (2) Total number of data points \rightarrow DE; initial data address \rightarrow HL
 (3) Call bit comparison subroutine
 (4) Shift all old data one bit to the left so that bit 7 of the high address byte is shifted into bit 0 of the adjacent low address byte

- (5) Total number of data points - 1 \rightarrow DE; initial data address \rightarrow HL
- (6) Call bit comparison subroutine
- (7) Return

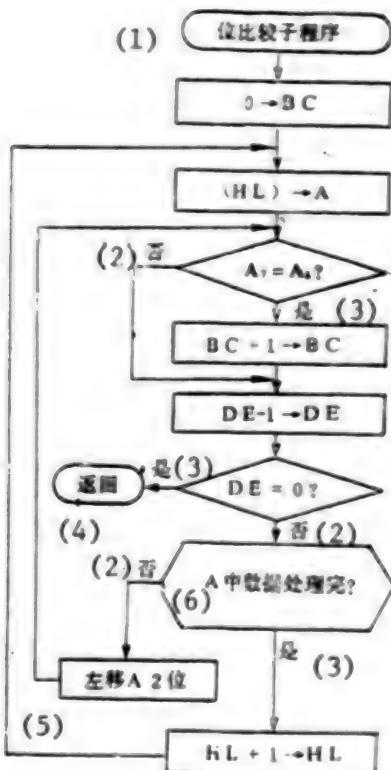


Figure 5. Flowchart of bit comparison subprogram.

KEY:

- (1) Bit comparison subprogram
- (2) No
- (3) Yes
- (4) Return
- (5) Shift A left by 2 bits
- (6) Has data processing in A finished?

IV. Measurement Precision

Because of the nonzero switching time of the 4P8255 data port from which the DBJ-80 receives the data directly, code errors may result if data are sampled while switching is in progress. However, the 4P8225A data port has a switching time of the order of 100 nanoseconds for signal bandwidths less than 1 kHz, so that the error rate is less than 1 in 10^4 , which is too low to affect the measurement results. Because the number of samples n is very large, the error in using the approximate formula above for the covariance is negligible (this was shown by the results of numerical experiments).

The device was tested in actual measurements for distances $L \sim 300m$ and nearly 300 of the measured values were compared with measurements made by a portable anemometer. The correlation coefficient and standard deviation were 0.93 and 0.23 m/s, respectively, for the two devices.

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APPLIED SCIENCES

SICHUAN COMPUTER APPLICATION CENTER PROMOTES RESEARCH

Beijing JINGJI RIBAO in Chinese 19 Jan 84 p 1

/Article by Zhou Ping /0719 1627/ /

/Text/ The Sichuan Computer Application Center initiated an intensive effort on microcomputer research, on importing foreign technology, and on promoting the use of microcomputers. They provided assistance to factories, hospitals, banks and athletic organizations in Sichuan province in installation and use of microcomputers, thus increasing their work efficiency and management standards.

Since 1978, the Sichuan Computer Application Center has completed 10 major computers research projects, 5 of which were first of its kind in China, and 3 received the Sichuan major scientific achievement award. In addition, 14 other projects are either under way or will begin in the near future. The microcomputer communication and conversion software which they developed for transplant applications is regarded to be of the same standard as other international software. They also developed the heart blockage and circulation automatic diagnosis system, which can measure over 20 different heart performance indicators in less than 24 seconds, thus providing a useful instrument for China's medical technology.

This Computer Application Center has also held many technical exchange meetings with foreign computer companies in an effort to import and absorb advanced foreign technologies. Furthermore, based on the needs of various industries in Sichuan Province, they have sponsored 4 computer application classes and have trained more than 400 key personnel in computer operation and application. They have also initiated cooperative efforts with certain organizations to promote the use of microcomputers in their work.

Currently, the Sichuan Computer Application Center is sending three survey teams to various industries in the province to identify problems for computer application, so that microcomputers can play a major role in future technical reform.

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APPLIED SCIENCES

COMPUTERS AND STANDARDIZATION

Beijing JINGJI RIBAO in Chinese 21 Jan 84 p 3

/Article by Yao Shiquan /1202 0013 0356/ /

/Text/ Like other engineering systems, the application and development of computer systems must be subject to standardization. A lesson in this regard can be learned from Great Britain's experience. Great Britain was the first country to develop a computer data network for general use; but since it did not use international standards, the system could not be fully utilized, nor could it interface with data systems of other countries and share their common resources. They were forced to abolish the old system and develop a new one; as a consequence, they fell behind other European countries which entered this field much later. Great Britain paid a dear price for not paying attention to standardization.

In the early 1960's, when computer application was still in its infancy, the International Standardization Organization (ISO) formed a technical committee for the standardization of computers and information processing, which resulted in the establishment of 126 international standards and 21 preliminary drafts of international standards. Because these standards provide versatility, serialization and interchangeability for computer systems, they are used extensively by many countries including the United States, Japan and Great Britain; some countries simply assigned a code to the international standards and declared them to be their own national standards. Since the 1980's, the standardization of computer information processing technologies has become an irreversible trend; even powerful companies like IBM which had insisted on its own standards were forced to take necessary technical measures so that the system performance of its products would be compatible with international standards. The United States Government allocates 10 million dollars each year on research to improve the standardization of information processing.

At present, China is devoting a great deal of effort to the development of computer information processing technology. We must seize this opportunity to establish various standards which include industrial and agricultural product codes, Chinese character input, Chinese character exchange codes, Chinese character output dot matrix, general high-level programming language and terminal interface. In particular, we must establish our national standards to be compatible with international standards. In developing and importing

computer equipment, we must limit the influx of production techniques and products which are not compatible with international standards. To change the technical standards of these products is often very costly in both manpower and materials.

In establishing China's financial management information system, we must have uniform standards for data collection format, document and table format, and data base design. In constructing computer application systems, each organization must consider the interfaces between departments, so they can be easily incorporated into the national or regional system network. Indeed, standardization is the responsibility of not only research organizations and manufacturers, but also application development organizations. Only when all parties involved dedicate their efforts to the standardization of information processing can China's computer industry and its associated application business reach a new level of high productivity and high efficiency. Only then will computers be used extensively in this country.

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APPLIED SCIENCES

SHANGHAI JIAOTONG UNIVERSITY, HONG KONG FIRM ON JOINT VENTURE

Beijing GUANGMING RIBAO in Chinese 27 Jan 84 p 3

/Article by Zhang Yifu /1728 6318 1788/ /

/Text/ Faced with the worldwide technology revolution, particularly the challenge of the rapidly-developing computer industry, Shanghai's Jiaotong University decided to draw on its rich technical talents to meet the challenge. In an effort to promote the development and application of microcomputers, the university recently established a technical arm in Hong Kong; specifically, the Nanyang International Technology Company, a subsidiary of Jiaotong University, entered into a joint venture with a Hong Kong firm to set up the Siyuan Computer Company, Ltd, whose main charter is to develop computer products. This venture is the first of its kind among China's higher institutions.

Jiaotong University established a microcomputer research office in 1979. By combining software and hardware, research and application, systems and components, this office has developed 11 prototype machines, 5 of which are already in production. Last year, 900 units were produced by both university-affiliated factories and outside factories. This year, the university-affiliated factories alone have received orders of 1,000 units, and as many as 17 applications-related topics have been designated for research and development. In order to accelerate the development of computer technology and to reach the advanced standards of developed countries, university experts were sent to Hong Kong to participate in computer exhibits, to cooperate with local firms to market their products on the international market, and to gather the latest information on the international market for the purpose of developing new technologies. The Siyuan Computer Company was primarily set up to accomplish these objectives.

The officer in charge of the Nanyang International Technology Company recently made the following comment to this reporter: "This new company is a joint product of education, research, development and trade. We expect to derive significant benefits from it in terms of absorbing advanced computer technologies, exporting computer products, reviewing China's education, research and products standards, and narrowing the gap between China's standards and those of advanced nations."

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APPLIED SCIENCES

CHINA'S INTEGRATED CIRCUITS IN 1990'S DISCUSSED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9, 8 May 84 p 3

[Article by Wang Yangyuan (3769 7122 0337), Assistant Professor, Beijing University: "On the Technical Targets China's Integrated Circuits Should Reach in the 1990's"]

[Text] I. Present Technical State of China's Integrated Circuits

On average, in terms of value of production, output, rate of finished product, and reliability, China's level of integrated circuit production is roughly the same as the level internationally in the mid and late sixties; in terms of industrial technology, it is equivalent to the level internationally of the early seventies. A few advanced plants should still be improved.

In scientific research and development of new products, China has made some advances, but a production capability has not yet taken shape. This indicates that the foundation has still not been laid for production of LSI circuits in China and it cannot "take off". From the encouraging advances of the last few years it can be seen that our LSI circuit industry is now in the stage of preparatory work before "taking off". To catch up with the international level of 1990 by the year 2000 means that we must complete a journey of 20 years experience internationally in about 16 years time. This task is enormous, not to mention that the "present" rate of our development cannot compare with the rate of development of such countries as the U.S. and Japan, and in the near term the gap may even become greater. Thus we should focus on how to increase the "acceleration" of our integrated circuits development.

II. The Technical Targets to be Reached in the 1990's

On the basis of China's current technological situation in integrated circuit production, I propose that we develop integrated circuit technology in three stages.

1. Foundation-laying Stage (1986-1990) To increase the "acceleration" of development, we should first of all focus on laying a good foundation so that integrated circuit production, special equipment and sets of fundamental materials are formed into a production network, master the fundamental industrial technology, open up the applications situation, and form a LSI circuit production capability. In terms of technical indicators, we should master the 30inch silicon chip and 3.5 micron processing precision. Ensure that such items as 4K MOS RAM, 16K dynamic RAM, 8-bit and 160bit microprocessors, 1,600-2,400 gate CMOS gate array logic circuits, and low power TTL Schottky circuits can be produced in large quantity to supply the market.

In development, the target should be to break through the industrial technological level of processing precision of about 2 microns. In circuit structure, we should pay special attention to development of CMOS circuits.

In scientific research, we should assign research work for processing precision of 2 microns and below, new industrial technology required for 250A thin oxidized layers, and new technology and its theoretical foundation. At the same time we should assign a few units to pursue preparatory research work for 1 micron, sub-micron and three-dimensional integrated technology.

2. Continuing Development Stage (1991-1995) Key emphasis should still be placed on continuing to develop LSI circuit production capability, and at the same time focus on gradually developing LSI circuit production technology. We should master 4-inch silicon chips and the production technology of 2 micron processing precision, to form a production capability. Bring about large volume production of 64K MOS RAM and 6,400-12,800 gate CMOS arrays. In terms of microprocessors, production of 16-bit processors should be primary, but we should be able to start producing 32-bit processors and 256K MOS RAM. We should begin to form a production capability for GaAs integrated circuits.

In development, we should make breakthroughs in 1 micron industrial technology and 5-inch silicon chips and expand research on sub-micron technology and its theoretical foundation.

3. The Stage of Producing VLSI Circuits (1996-2000) This period is the stage in which China forms a VLSI circuit production capability. A capability to produce 5-inch silicon chips and 1 micron processing technology should take shape; and we should be able to produce 256K and 512K MOS RAM and 32-bit microprocessors in large quantities. We should also be able to produce 1 Mb memories. We should begin work on developing sub-micron processing precision and new three dimensional integrated circuit products. We should start research on new generation of integrated circuits such as the high TC value superconductors and bioelectronic components. At this time, China's level of integrated circuits can reach a level equivalent to that of the U.S. in 1990.

The correct technological targets and strategies are necessary conditions for success, but they are not the only conditions. To ensure the realization of the above targets, we must stress that in the next 2 years, full development of the superiority of the socialist system, do a good job of strengthening organizational alliances, unifying plans, rational division of labor, unified investment, fully utilizing advanced equipment and technology, and doing a good job of such work as digesting, absorbing, and development and strengthening such tasks as intelligent investment and accelerating training.

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APPLIED SCIENCES

CHINESE-ENGLISH 3276 EMULATOR DEVELOPED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9, 8 May 84 p 6

[Article: "Chinese-English 3276 Emulator Developed"]

[Text] The State Planning Commission's Computer Center and the Guangzhou Provincial Planning Commission Computer Station cooperated to develop a Chinese-English 3276 emulator program on a Japanese-manufacture Toyo LBC220 Chinese-English microcomputer system. After the LBC220 was equipped with this program, it could be linked up to an IBM4300 equipped DOS/VSE system in BSC mode and under the support of the host computer systems BTAM (basic remote communications access method) could become a remote Chinese-English terminal for ICCF, CICS, and DL/I system programs by means of an IBM3276-2 display control station. In initial tests, simplified Chinese characters were input and output to an ICCF/CICS system, and using an ICCF edit command edited Chinese files in an ICCF library, and added Chinese headings to data in a DL/I link database and displayed it. The development of this program will provide an effective technique for expanding the application of imported medium and mini-computers in government departments.

The important features of the Chinese-English 3276 emulator are: no modifications need be made for microcomputer hardware: by executing the BSC protocol, it can be connected to host computer systems in remote multiple modes with a synchronous modem; it can interpret and execute all IBM3276 commands and emulate all IBM3276 display attributes, such as high intensity display, no display, and protection field, and can emulate the 13 program function keys (PF₁-PF₁₃), 2 program attention keys (PA1-PA2) and an erase key. In addition the program has a certain degree of transportability.

Currently this work is still undergoing improvement and expansion with a view to making the LBC220 emulator into a BSC3276 concentrated controller and in short-range mode controlling multiple Chinese terminals (emulating the IBM3278) and Chinese printer (emulating the IBM3287) so that printers and other devices equipped with the LBC-220 can also be used when linked with an IBM4300.

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APPLIED SCIENCES

CHINESE CHARACTER PROCESSING SYSTEM DEVELOPED IN ANHUI

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9, 8 May 84 p 6

[Article: "DMCS Multi-user Chinese Character Processing System Developed on HORIZON Computer"]

[Text] The Anhui Institute of Electronics recently developed a DMCS multi-user Chinese character processing system using a Northstar HORIZON multi-user microcomputer. The system uses distributed structure design and is implemented by an expanded basic operating system method. A system-supported dBASE II data base is currently in use in the provincial banking affairs processing system.

The system uses a combined centralized and decentralized mode: public processing is centralized and the rest is decentralized to subsystems. Each user carries out Chinese character/alphabetic character processing independently and can load or leave DMCS at the system prompt at any time. When a user encounters trouble, the other users can still work normally. Through the SPOOL system, many users can output Chinese characters/alphanumerics at the same time.

The system is easy to use and can be loaded both automatically or manually. It supports many languages and dBASE II, and has form processing capability. A character library of over 8,000 characters is stored on hard disk and varieties of maintenance can be carried out on the character stock through a character library service program.

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CSO: 4008/1006

APPLIED SCIENCES

NEW MICROCOMPUTER DEVELOPMENT SYSTEM DESCRIBED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9, 8 May 84 p 7

[Article: "Ministry of Electronics Industry's Institute of Promoting Electronics Technology Applications: Develops New Microcomputer Development System"]

[Text] The Institute of Promoting Electronics Technology Applications of the Ministry of Electronics Industry recently finalized a model of a new microcomputer development system--the CMDS Development System--in Beijing. This is a tool for development work on 050-series microcomputers, i.e., it can be used to develop microcomputer systems with 8080, 8085, 8086, and 8088 CPUs and it can also be used to develop 8048 and 8051 single-board computer systems.

This development system is made up of some DJS050 single-boards, is bus-oriented and uses ROM and disk-based software. The system software is compatible with Intellect development software, ISIS-II and CP/M 2.2 operating systems and software supported by them can run on it. The system has powerful expansion capabilities, such as increasing memory and expanding I/O ports to support a range of peripherals and 16-bit computer emulation. All products which conform to Multibus bus protocols can enter the system directly and perform many special functions for the user and at the same time through increasing modules can directly upgrade it to a 16-bit computer development system. The new system can rapidly establish a stable and reusable debugging environment and can also carry out emulation debugging on system software and hardware.

Last year, this development software was included in the new product fair held by the Ministry of Electronics Industry and at temperatures of approximately 30°C operated on-line continuously and stably for 1 month.

The representatives who participated in the evaluation conference gave high marks to the development of this system and felt that it provided domestic 050 series microcomputer users a powerful development technique and was really worth promoting.

The development system will be produced by the state run 830 plant.

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APPLIED SCIENCES

MODEL TRN-I CHINESE-ENGLISH INTELLIGENT TERMINAL

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9, 8 May 84 p 7

[Article: "Hangzhou Institute of Automation Produces TRN-I Chinese-Western Language Intelligent Terminal"]

[Text] The TRN-I intelligent terminal which can use Chinese and Western languages and which was developed by the Hangzhou Institute of Automation recently passed scientific and technical evaluation. This terminal includes an intelligent Chinese character keyboard and an intelligent controller. Information exchange follows the GB2312-80 state standard. The hardware interface is an RS-232C communications interface and it can be readily connected to different host computers for Chinese input, Chinese screen display and printed output, and has good general purpose performance. The terminal has 71 editing, display and print functions. The intelligent Chinese character keyboard can implement a variety of Chinese character input schemes, as well as implement special phrase association character schemes, the intelligent display and print controller has color and black and white output, uses character regeneration display mode, search speed is fast, it has Chinese, English, and graphic display information and a variety of control functions, and it can adapt to the needs of different users. The evaluators felt that this terminal achieved the domestic advanced level for similar products.

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APPLIED SCIENCES

CAPABILITIES OF CHINA'S TQ-16 COMPUTERS EXPANDED

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9, 8 May 84 p 10

[Article by Wu Haiming [0702 3189 2494], President of the TQ-16 Computer Society: "Affirm Achievements, Strengthen Cooperation; Continue To Make the Most of the TQ-16 Computer"]

[Text] The TQ-16 computer, and the 709 and 719 computers which are similar to it, are domestic general purpose computers which are produced in volume and widely used. They are distributed mainly in scientific research and design departments, institutions of higher learning, and large scale plants and mining enterprises among which there are over 100 large design institutes alone.

For the past 10 or more years, through cooperation, many users have achieved many new accomplishments in hardware innovation and expansion and in software research and development. In terms of hardware, there have been added long and short distance multi-terminal systems, multi-computer communications systems, clock systems and various models disk drives, graphers, plotters, perforators, cassette tape input/output devices and memory expansion and replacement of MOS memory. In terms of system software, magnetic disks and magnetic drum operating systems and assembly, FORTRAN, BCY, general purpose engineering graphics, digital control mechanical processing line cut-off language, Chinese character processing systems and other service programs for general use have been added. There has been a great deal of expansion in ALGOL interpreter systems and management programs. The development of applications software has been even broader. According to preliminary statistics of just a few large departments, there are more than 3,000 applications programs which have been developed and are in use. Some businesses have created applications program libraries and data bases. These results have clearly expanded the processing functions of this old machine, improved the effectiveness of system operations, and broadened the areas of application. This has been welcomed by users.

In the past dozen years, these three computers have taken on a large amount of the scientific and technical computing tasks for China's socialist construction. The data processing of many important scientific

research, design, production, national defense construction and higher education, in addition a large group of computer applications talent has been trained and this is an historical achievement. Users in generally feel that it is wrong to exaggerate the defects of domestically manufactured computers and one-sidedly denigrate the role of domestically manufactured computers. We should strengthen our confidence in promoting the application of domestically manufactured computers.

While affirming our achievements, we also should note that with the development of science and technology and the improvement in the level of applications, these three computers can no longer satisfy the needs of some users and they are preparing for or already carry out replacement of machines. Thus, in addition to continuing to organized technical cooperative activity with the TQ-16, 709 and 719 computers, the society will actively begin technical consultation on computer model replacement and special topic scholarly activity on the new models which users need urgently. Thus, a new model cooperation group has already been established to stress cooperation in protecting and transplanting software resources. The TQ-16 Computer Society will strive to continue to bring out the best in these old machines.

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APPLIED SCIENCES

USE OF MICRO-, MINI-COMPUTERS AT HANGZHOU INSTITUTE OF ELECTRONICS INDUSTRY

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9, 8 May
84 p 1

[Article: "Hangzhou Institute of Electronics Industry; Gets Results
Developing Optimized Algorithms on Micro- and Mini-computers"]

[Text] Applying computers to optimum process of mathematical models of input-output systems engineering and determining the best proposal among economic and production tasks is an important technique for improving economic results. However, because mathematical models are very complex, it frequency requires a medium- or large-scale computer to process them.

The Hangzhou Institute of Electronics Industry, on the basis of China's national circumstances, courageously carried out a test run of this task on mini- and micro-computers. After a great deal of experimentation, they finally found a new algorithm for processing linear optimization problems--the yuanshuhuan [0337 2422 2255] algorithm. This algorithm is relatively simple and requires very little open memory space and is suitable for use on minicomputers and microcomputers to process many problems in linear optimization.

The Hangzhou Institute of Electronics Industry used this algorithm to write a computer-assisted planning program and last year process many optimization problems of the Hangzhou Iron and Steel Works input-output model using a domestic BCM III microcomputer with only 64K memory. In addition, using a program written in expanded BASIC on a DJS-130 mini-computer, they used a single-computer distributive prece-sing model to compute an enormous lieangjiefuni [0441 2491 2212 1133 6627] array and also carried out predictive computations on the prospects for the next 10 years for 17 products which provided satisfying optimum planning proposals so that the plant's foreign purchasing investment was reduced by 6 million yuan and increased the profits by over 3 million yuan above the original plan.

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SHANGHAI HUADONG COMPUTING INSTITUTE TESTS CAMBEX 1600-SERIES COMPUTERS

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9, 8 May
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[Article: "Shanghai Huadong Computing Institute Conducts Compatibility Tests on the 1600-Series Computers"]

[Text] Recently, at the Shanghai Huadong Computing Institute, a Cambex 1600-series computer compatibility evaluation committee composed of specialists from Shanghai Jiaotong University, Fudan University, and the Computing Institute of the Academy of Sciences conducted a conscientious testing of the compatibility of the 1600-series and IBM 370 and 4300 series. They ran 30 applications programs (including different types of scientific calculations and data processing) written in FORTRAN, PL/I, COBOL, RPG0II and assembly language on the 1641-11 and 1636-10 computers using DOS/VSE, VM/SP(CMS), and VM/SP(CMS/DOS) operating systems and obtain results as accurate as those obtained when run originally on the IBM computers. This indicates that the system software and applications of the IBM computers under similar software conditions, will run on the 1600-series computers without any revisions.

The Cambex 1600-series computers are medium-sized general purpose data processing computers which are connector compatible with the IBM 370 and 4300 series computers, the systems are complete, and the CPU, main memory and channels can be upgraded on the spot. The computers have remote maintenance support and remote communications capability, they can function as independent data processing systems as well as function as host computer nodes, preprocessors, and backup in distributed network environments and obey IBM communications protocols. Their price/performance ration is higher than the similar grade IBM computers.

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APPLIED SCIENCES

EFFECTIVE RESULTS OBTAINED VIA NORTH-WEST NETWORKING

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9, 8 May
84 p 1

[Article: "Northwest Electric Power Network Data Acquisitions and Monitoring Microcomputer System Operation Gets Effective Results"]

[Text] The Northwest Electric Power Network Realtime Data Acquisitions and Monitoring Microcomputer System recently went into operation so that automatic information transfer and centralized management could be realized between the Xian Dispatch Office and the power plants in the Northwest Electric Power Network, including such large electric power plants as the Liujiashia, Bikoushui, and Qinling No 2 power plants.

This microcomputer system was developed by the Ministry of Water Resources and Electric Power's Nanjing Automation Institute. The system is made up of two 16-bit microcomputers and two 8-bit microcomputers and a number of remote terminals made up of single-board computers. One 16-bit microcomputer with an 8086 for CPU is installed at the Gansu Power Network Dispatch Office, for realtime collection of generating data sent from the generating plants and after processing it sends it on to the Northwest Electric Power Network's General Dispatch Office in Xian. The General Dispatch Office also has a 16-bit microcomputer with an 8086 for CPU and it both accepts the data sent from the Gansu Dispatch Office and operations data of the power plants of the Shaanxi Electric Power Network and assembles and displays for the General Dispatch Office the electric power network operations situation, including volume of hydroelectric power, volume of thermoelectric power, volume of power generated by hydroelectric plants and thermoelectric plants, and the main operating parameters of the entire network. The system can provide scientific basis for scientific management and rational production of the electric power network.

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APPLIED SCIENCES

DEVELOPING SOFTWARE FOR CHINA'S 'GREAT WALL' MICROCOMPUTER

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9, 8 May
84 p 1

[Article: "0520 Microcomputer Software Takes the Path of Joint Development"]

[Text] Because of its excellent performance, rational configuration, and Chinese character system, the "Great Wall" 0520 microcomputer China produced last year has been welcomed by domestic users and is becoming an important microcomputer in China. To promote its spread and use, reduce as quickly as possible the volume of secondary user development, and gradually establish and perfect software standardization and commercialization, the Ministry of Electronics Industry's Computer Management Bureau recently organized an 0502 Computer Software Development Consortium. The units in the consortium are cooperating, linking up into a whole, and jointly undertaking development, analysis, and transplanting of applications software for this computer, and they jointly observe one set of software development management standards and marketing methods. This is the first time this form has been adopted for one specific computer in China and it will play an enormous role in promoting the extensive application of this computer.

This consortium was formed recently when the Bureau convened an 0520 Software Work Conference in Beijing. Over 70 representatives from more than 50 units nation-wide attended the conference. At the conference, everyone discussed in detail the function of this computer in China's office automation management and the software items that need to be developed, and in a preliminary way determined the development targets for this year and next. The Computer Management Bureau signed draft contracts with over 20 units for over 50 tasks and jointly with the representatives formulated a provisional method for software development and marketing management. The establishment of the 0520 Consortium will play a beneficial role in promoting software development for the 0520 microcomputer.

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THE STEP STRUCTURE EFFECT OF DC JOSEPHSON CURRENT WITHIN ONE FLUX QUANTUM PERIOD $\phi_0/11$

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[Article by Zhang Yuheng [1728 5940 1854], Shen Xiuling [3088 4423 3781], Zheng Jiefei [6774 2212 7378] and Wu Yan [0702 1750] of the Department of Physics, University of Science and Technology of China, Hefei and Wang Maoquan [3076 5399 3123] of the Institute of Plasma, Chinese Academy of Sciences, Hefei: "The Step Structure Effect of DC Josephson Current Within One Flux Quantum Period $\phi_0/11$: Josephson Junctions of Large Dimension"]

[Text] Abstract

We report that by placing a large Josephson junction in a high-Q cavity whose r th eigen-mode is excited by the Josephson frequency $\omega = 2eV_0/h$, the oscillating electromagnetic field will feedback to the junction and one must recognize that the spatial parts of the eigen-mode of the feedback field are not the same on the junction. We have obtained theoretical results different from those of Ref 2, and experimental results showing how the step structure current vary with the magnetic field. The match condition for eigen-mode of the feedback field from the cavity and electromagnetic field radiated by Josephson junction has been worked out. Finally, the physical reason for the absence of step structure with period less than ϕ_0 is given.

1. Introduction

Step structure effect with period less than ϕ_0 produced by Josephson junction and double junction SQUID in a high Q cavity has been studied and reported in Refs 1 and 2. This naturally leads to the investigation of large dimension Josephson junctions.

When a large dimension Josephson junction is placed in a high Q cavity, a standing wave electromagnetic field is produced in the cavity when the Josephson frequency $\omega = 2eV_0/h$ matches the resonance frequency of the cavity. This field is fed back to the junction and the spatial components of the eigen-mode are different at different locations of the junction. The phase associated with this field is a function of space. We have obtained theoretical results describing the

magnetic field dependence of the feedback amplitude and the step structure in the current. Reasons are given for the different results obtained from a large junction and a small junction.

II. Magnetic Field Dependence of Step Structure Current and Feedback Field

1. Theory

Consider a long strip Josephson junction in the xy plane, and let the dimensions in the x and y directions be l_x and l_y , respectively, and $l_x \gg l_y$. When an external magnetic field H is applied to the junction in the y direction, then the field in the junction is homogeneous when l_y is less than the Josephson penetration depth λ_J , $\lambda_J = (hc^2/8\pi j_c e \Lambda)^{1/2}$ and variations in the y direction may be neglected. When a constant voltage V_0 is applied in the x direction, the Josephson equation can be written as

$$j_i(x, t) = j_c \sin(\omega t + kx + \varphi_0), \quad (1)$$

where $\omega = 2eV_0/\hbar$, $k = 2e\Lambda H/hc$, $\Lambda = 2\lambda + d$ is the penetration depth of the magnetic field, λ is the penetration depth, d is the thickness of the insulating layer, j_c is the critical current density of the Josephson junction and φ_0 is the initial phase.

When the junction is placed in a high Q cavity and subjected to a voltage V_0 , the junction will radiate electromagnetic waves at a frequency $\omega = 2eV_0/\hbar$. When ω matches the r th eigen frequency ω_r of the cavity, a standing wave field is excited in the cavity and this field will feed back onto the junction just like an externally applied radiation.

Let the oscillating voltage of the feedback field be

$$V_r(x, t) = V_r \xi_r(x, y_0, z_0) \cos(\omega_r t + \theta), \quad (2)$$

then Equation (1) may be rewritten as

$$j_i(x, t) = j_c \sin \left[\omega t + kx + \varphi_0 + \frac{2eV_r}{\hbar\omega_r} \xi_r(x, y_0, z_0) \sin(\omega_r t + \theta) \right]. \quad (3)$$

Using the formula

$$\sin(s \sin \varphi + a) = \sum_{m=-\infty}^{\infty} J_m(s) \sin(d + m\varphi),$$

Equation (3) becomes

$$j_i(x, t) = j_c \sum_{m=-\infty}^{\infty} J_m \left[\frac{2eV_r}{\hbar\omega_r} \xi_r(x, y_0, z_0) \right] \sin[(\omega + m\omega_r)t + kx + \varphi_0 + m\theta], \quad (4)$$

and the current in the junction is

$$I_s = i_c \int_{x_1}^{x_2} dx \int_{y_1}^{y_2} dy \left\{ \sum_{m=-n}^n J_m \left[\frac{2eV_m}{\hbar\omega_r} \xi_m(x, y_0, z_0) \right] \right. \\ \left. \cdot \sin [(\omega + m\omega_r)t + kx + \varphi_0 + m\theta] \right\}, \quad (5)$$

where $x_2 - x_1 = l_x$ and $y_2 - y_1 = l_y$.

When $\omega + m\omega_r = 0$ or $\omega = -m\omega_r = n\omega_r$ in Equation (5), the time average of I_s is not zero and

$$\bar{I}_s = (-1)^n [A \sin(\varphi_0 - n\theta) + B \cos(\varphi_0 - n\theta)] i_c l_s, \quad (6a)$$

where

$$A = \int_{x_1}^{x_2} J_m \left[\frac{2eV_m}{\hbar\omega_r} \xi_m(x, y_0, z_0) \right] \cos kx dx, \quad (6b)$$

$$B = \int_{x_1}^{x_2} J_m \left[\frac{2eV_m}{\hbar\omega_r} \xi_m(x, y_0, z_0) \right] \sin kx dx. \quad (6c)$$

Following Ref 2 and making the following substitutions

$$\sin(\varphi_0 - n\theta) = \frac{A}{\sqrt{A^2 + B^2}},$$

$$\cos(\varphi_0 - n\theta) = \frac{B}{\sqrt{A^2 + B^2}},$$

we have the height of the nth step structure of the current

$$\Delta \bar{I}_s = |\sqrt{A^2 + B^2}| i_c l_s. \quad (7)$$

Since the junction is placed in the resonance cavity, j_s or I_s in Equations (4) and (5) are the excitation sources. When Q is large, the resonance curve is a delta function and only the ω_r component of j_s and I_s needs to be considered. From Equation (4), when $\omega + m\omega_r = \pm\omega_r$ the corresponding current density j_{ω_r} excites the cavity. The two terms corresponding to $m = -n \pm 1$ (n is a nonzero integer) in Equation (4) have the following excitation current density at frequency ω_r

$$j_{\omega_r} = i_c J_{-n+1} \left[\frac{2eV_m}{\hbar\omega_r} \xi_m(x, y_0, z_0) \right] \sin [kx + \varphi_0 - (n-1)\theta + \omega_r t] \\ + i_c J_{-n-1} \left[\frac{2eV_m}{\hbar\omega_r} \xi_m(x, y_0, z_0) \right] \sin [kx + \varphi_0 - (n+1)\theta - \omega_r t], \quad (8a)$$

and the excitation current is

$$I_n = j_d \int_{x_1}^{x_2} \left\{ J_{-n+1} \left[\frac{2\epsilon V_n}{\hbar\omega} \xi_n(x, y_0, z_0) \right] \sin [kx + \varphi_0 - (n-1)\theta + \omega_n t] + J_{-n-1} \left[\frac{2\epsilon V_n}{\hbar\omega} \xi_n(x, y_0, z_0) \right] \sin [kx + \varphi_0 - (n+1)\theta - \omega_n t] \right\} dx. \quad (8b)$$

From microwave theory,

$$E = -\frac{Q\xi_r}{sN\omega_r} \int_v j_{\omega_r} \cdot \xi_r d\nu,$$

where Q is the quality factor of the cavity, j_{ω_r} is the excitation current density at frequency ω_r , ϵ is the dielectric constant, and ξ_r is the spatial part of the eigen-mode at ω_r . The modulus of ξ_r is

$$\int_v \xi_r \cdot \xi_r d\nu = N\delta_{rr}, \quad (9)$$

where the integral is over the entire volume of the cavity.

(A) Narrow lead

Since j_{ω_r} is nonzero only over the volume $l_x l_y \Lambda$ of the tunnel junction and in the lead $S(\omega - \Lambda)$, here S is the cross-sectional area of the lead and ω is the height of the cavity, the integral in Equation (9) can be written as

$$\int_v j_{\omega_r} \cdot \xi_r d\nu = \int_{v_1} j_{\omega_r} \cdot \xi_r d\nu + \int_{v_2} j_{\omega_r} \cdot \xi_r d\nu, \quad (10)$$

where $v_1 = l_x l_y \Lambda$ and $v_2 = S(\omega - \Lambda)$. Because of the continuity condition, the current is the same over the junction area $l_x l_y$ and over the cross-section of the lead S .

Since Λ is small, j_{ω_r} may be regarded as a constant in the z direction in the Λ layer, hence,

$$\int_{v_1} j_{\omega_r} \cdot \xi_r d\nu = \Lambda \int_{l_x l_y} j_{\omega_r} \cdot \xi_r dS. \quad (11a)$$

Since the cross-section of the lead is much smaller than the cavity size, the eigen mode ξ_r is basically constant over the cross-section of the lead and

$$\int_{v_2} j_{\omega_r} \cdot \xi_r d\nu = \int_S j_{\omega_r} dS \int_l \xi_r \cdot dl = I_{\omega_r} \int_l \xi_r \cdot dl. \quad (11b)$$

Since Λ is of the order of 10^{-5} cm and ω is of the order of 1 cm, Equation (11a) may be neglected in comparison with (11b) and Equation (9) becomes

$$E = -\frac{Q\xi_r}{sN\omega_r} I_{\omega_r} \int_l \xi_r \cdot dl. \quad (12)$$

For a Josephson junction

$$V_r = \mathbf{E} \cdot \mathbf{A} = -\frac{Q\mathbf{E}_r \cdot \mathbf{A}}{eN\omega_r} I_{av} \int_I \mathbf{E}_r \cdot d\mathbf{l}. \quad (13)$$

Combine Equations (2), (8b) and (13), we have

$$\begin{aligned} V_{av}\xi_s(x, y_s, z_s) \cos(\omega_s t + \theta) = & -\frac{Q i_s \mathbf{E}_r \cdot \mathbf{A}}{eN\omega_s} \left(\int_I \mathbf{E}_r \cdot d\mathbf{l} \right) \\ & \cdot \left\{ \int_{z_1}^{z_2} J_{-s+1} \left[\frac{2eV_{av}}{\hbar\omega_s} \xi_s(x, y_s, z_s) \right] [\sin(\omega_s t + \theta) \cos(kx + \varphi_s - n\theta) \right. \\ & + \cos(\omega_s t + \theta) \sin(kx + \varphi_s - n\theta)] dx \\ & + \int_{z_1}^{z_2} J_{-s-1} \left[\frac{2eV_{av}}{\hbar\omega_s} \xi_s(x, y_s, z_s) \right] [-\sin(\omega_s t + \theta) \cos(kx + \varphi_s - n\theta) \\ & \left. + \cos(\omega_s t + \theta) \sin(kx + \varphi_s - n\theta)] dz \right\}. \end{aligned} \quad (14)$$

Using the orthogonality of the trigonometric functions and Equations (6b) and (6c), Equation (14) becomes

$$\begin{aligned} V_{av}\xi_s(x, y_s, z_s) = & (-1)^{s+1} \frac{Q i_s J_{-s} \mathbf{E}_r \cdot \mathbf{A}}{eN} \frac{1}{\sqrt{A^2 + B^2}} \left(\int_I \mathbf{E}_r \cdot d\mathbf{l} \right) \\ & \cdot \left\{ \int_{z_1}^{z_2} \frac{1}{\xi_s(x, y_s, z_s)} J_s \left[\frac{2eV_{av}}{\hbar\omega_s} \xi_s(x, y_s, z_s) \right] (A \cos kx + B \sin kx) dx \right\}. \end{aligned} \quad (15)$$

(B) Wide lead

If the cross-section of the lead is equal to that of the junction, we have, from Equations (9) and (13), that

$$V_r = -\frac{Q\mathbf{E}_r \cdot \mathbf{A}}{eN\omega_r} \int_I \mathbf{j}_{av} \cdot \mathbf{E}_r d\mathbf{l}. \quad (16)$$

Following the derivation for the narrow lead, we have

$$\begin{aligned} V_{av}\xi_s(x, y_s, z_s) = & (-1)^{s+1} \frac{Q i_s J_{-s} \mathbf{E}_r \cdot \mathbf{A}}{eN} \frac{1}{\sqrt{A^2 + B^2}} \\ & \cdot \left\{ \int_{z_1}^{z_2} \frac{1}{\xi_s(x, y_s, z_s)} J_s \left[\frac{2eV_{av}}{\hbar\omega_s} \xi_s(x, y_s, z_s) \right] \right. \\ & \left. \cdot (A \cos kx + B \sin kx) \left(\int_I \mathbf{E}_r \cdot d\mathbf{l} \right) dx \right\}. \end{aligned} \quad (17)$$

For a given magnetic field (or k), the magnetic field dependence of $\Delta\bar{I}_s$ can be obtained by solving the integral Equations (15) and (17) for V_{ro} and then substituting into Equation (7).

2. V_{ro} -H and $\Delta\bar{I}$ -H

We now assume that the cavity is a parallelopiped with dimensions a , b and w along the x , y and z directions. Taking E to be of the $E_{k'l'm}$ mode, then the spatial parts of the electric field are

$$\xi_s = (0, 0, \xi_s), \quad (18)$$

$$\xi_s = \sin \frac{k' \pi}{a} x \cdot \sin \frac{l' \pi}{b} y \quad k', l' = 1, 2, 3 \dots \quad (19)$$

the eigen frequency is

$$\omega_s = \pi c \left(\frac{k'^2}{a^2} + \frac{l'^2}{b^2} \right)^{1/2},$$

where C is the speed of light, and the modulus of ξ_s is

$$N = \int_s \xi_s^2 ds = \frac{1}{4} abw. \quad (20)$$

Since Λ and $d\ell$ are in the z direction, we have

$$\xi_s(x, y_s, z_s) \cdot \Lambda = \xi_s(x, y_s, z_s) \Lambda, \quad (21)$$

$$\int \xi_s \cdot d\ell = \int \xi_s ds = \xi_s \left[\frac{1}{2} (x_1 + x_2), y_s, z_s \right] w \quad \text{narrow lead} \quad (22a)$$

$$\int \xi_s \cdot d\ell = \xi_s(x, y_s, z_s) w \quad x_1 < x < x_2 \quad \text{wide lead} \quad (22b)$$

Since V_{ro} does not depend on the lead size very strongly, (22a) and (22b) imply that the right hand sides of Equations (15) and (17) can differ at most $\pi/2$. We will therefore only discuss the narrow lead case.

Substituting Equations (20), (21) and (22a) into (15), and focusing our interest to the maximum V_{ro} , Equation (15) becomes

$$V_{ro}^s = \frac{4\pi Q A B j_c l_y}{\epsilon \pi ab} \xi_s \left[\frac{1}{2} (x_1 + x_2), y_s, z_s \right] \cdot \frac{1}{\sqrt{A^2 + B^2}} \cdot \int_{x_1}^{x_2} \frac{1}{\xi_s(x, y_s, z_s)} J_s \left[\frac{2\pi V_{ro}}{\Lambda \omega_s} \xi_s(x, y_s, z_s) \right] (A \cos kx + B \sin kx) dx. \quad (23)$$

Assuming $\Lambda = 1.38 \times 10^{-7}$ m, $j_c = 4 \times 10^3$ A/m², $\epsilon = \epsilon_0 = 8.85 \times 10^{-12}$ C/N·m², $a = b = 10^{-2}$ m and $k' = l' = 1$, we have $\omega_s = 130$ GHz/s. Assuming $l_y = 5 \times 10^{-4}$ m and $l_x = 5 \times 10^{-3}$ m (i.e., $x_1 = 0$, $x_2 = 5 \times 10^{-3}$ m), we have computed the H dependence of V_{ro} from Equation (23) for $Q = 100, 1,000$ and $10,000$. The results are shown in Figure 1. Substituting the $V_{ro}(H)$ obtained numerically from Equation (23) into Equation (7), we have the field dependence of the step current, as shown in Figure 2.

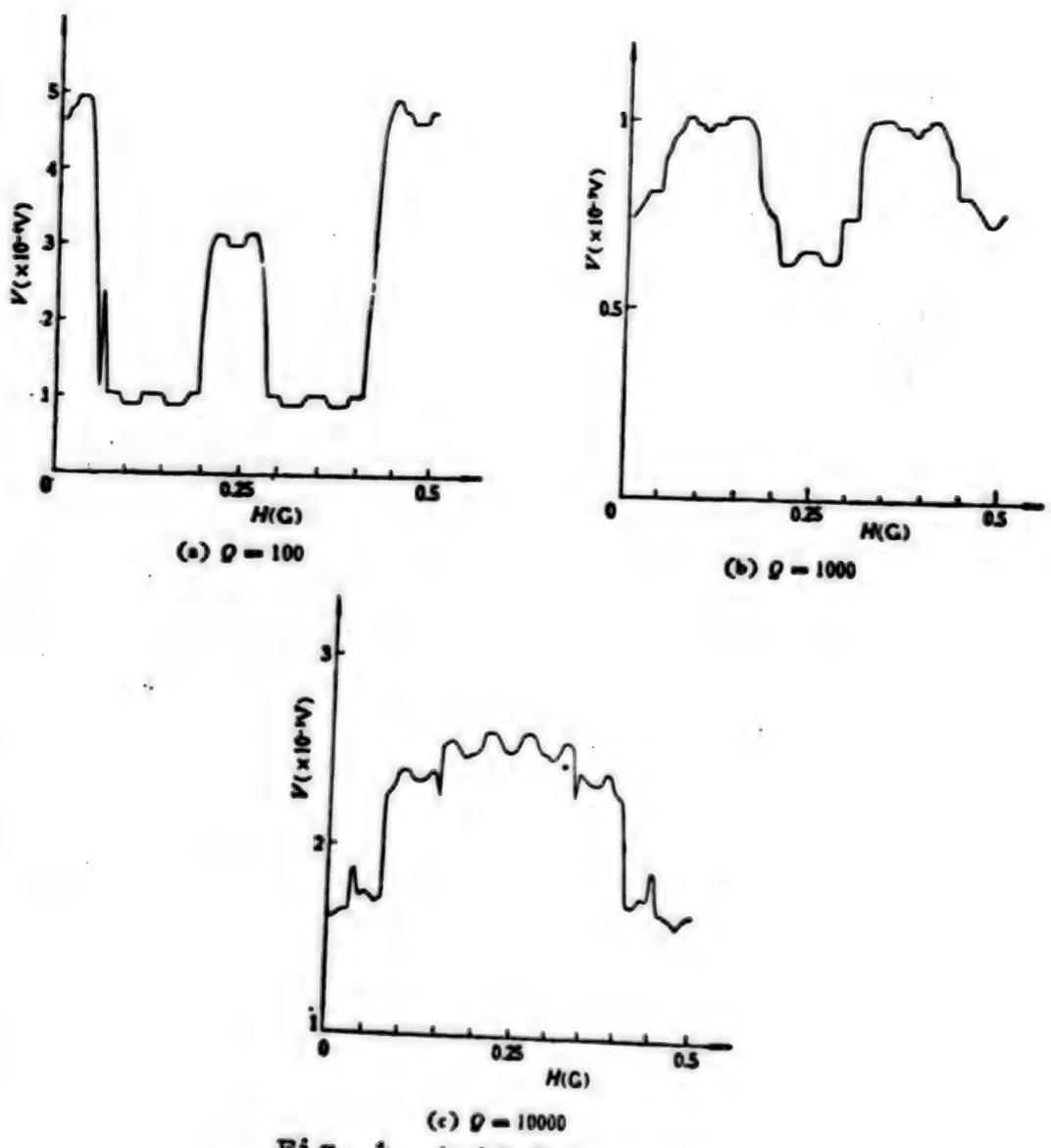


Fig. 1. $I_s: 0 \leq r \leq 5 \times 10^3 m$

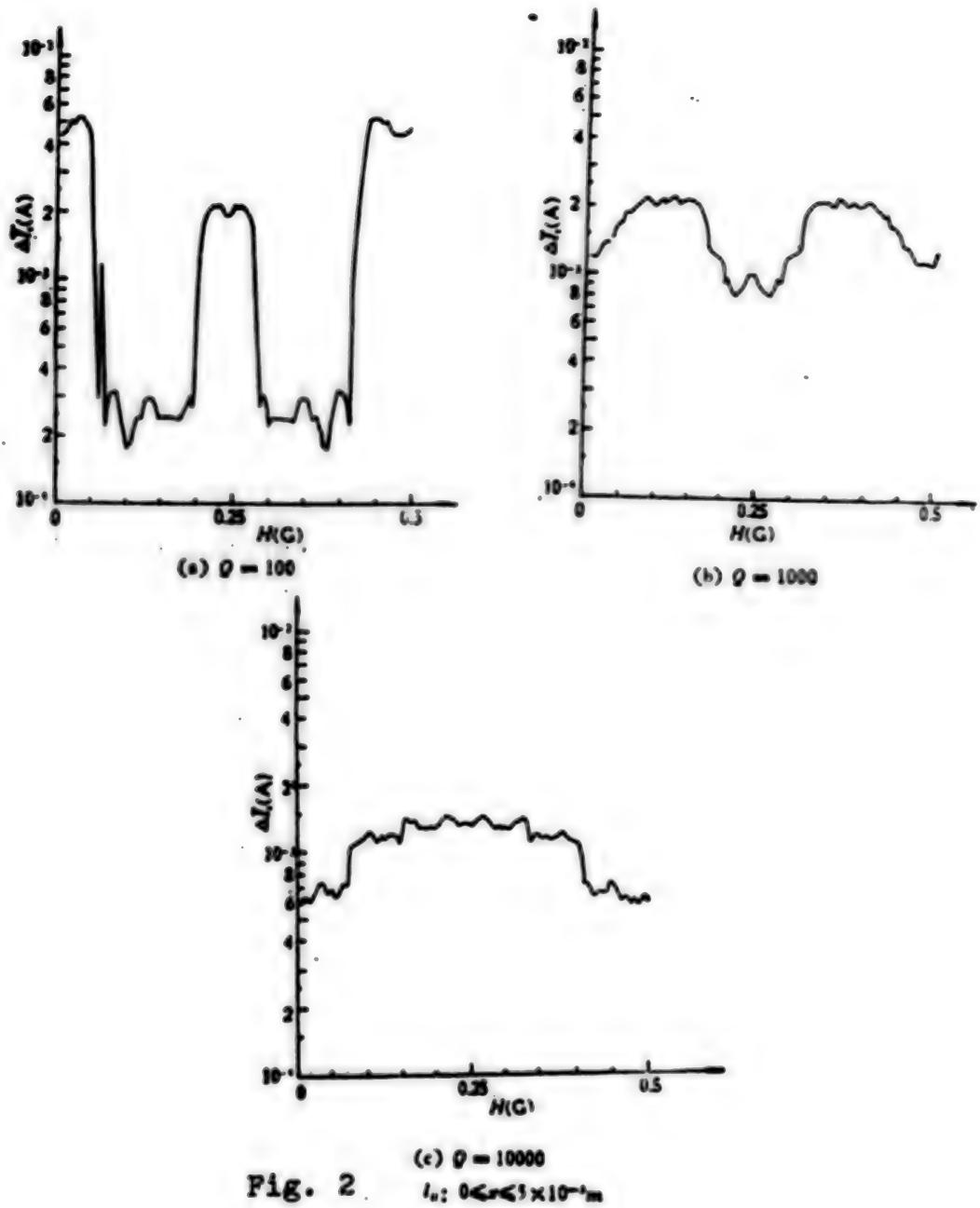


Fig. 2

III. Discussion

1. Physical origin for the absence of step currents in dc Josephson junction

In the study of a small Josephson junction placed in a high Q cavity,² multiple steps were observed in the V_{ro} versus H and ΔI_s versus H curves within one flux quantum. One of the authors (Zhang) has studied the physical origin for the step current,³ and pointed out that the steps are caused by a spatial match of the electromagnetic modes emitted by the excitation source. I_{ω_r} and the eigen modes excited in the cavity.

As shown in Figures 1 and 2, V_{ro} and ΔI_s have no steps for a large Josephson junction. To explore the physical origin, we calculated the case of external magnetic H parallel to the long dimension of the junction in the x direction and obtained a result simpler than Equation (23).

$$V_{ro}^2 = \frac{4\pi\hbar Q l_s l_s A}{c\epsilon_{ab}} \left| \xi_s \left[\frac{1}{2} (x_1 + x_2), y_s, z_s \right] \frac{\sin \frac{\pi \Phi_s}{\Phi_0}}{\frac{\pi \Phi_s}{\Phi_0}} \cdot \int_{x_1}^{x_2} \frac{1}{\xi_s(x, y_s, z_s)} J_0 \left[\frac{2\epsilon V_{ro}}{\hbar\omega_s} \xi_s(x, y_s, z_s) \right] dx \right|. \quad (24)$$

If we divide the space between x_1 and x_2 into m equal parts: $x_1, x^{(1)}, x^{(2)}, \dots, x^{(m-1)}, x_2$ so that $x^{(1)} - x^{(i-1)}$ is the dimension of the small Josephson junction, then, we may let $x_1 = x^{(0)}$ and $x_2 = x^{(m)}$ and rewrite Equation (24) as follows

$$V_{ro}^2 = \frac{4\pi\hbar Q l_s l_s A}{c\epsilon_{ab}} \left| \xi_s \left[\frac{1}{2} (x_1 + x_2), y_s, z_s \right] \frac{\sin \frac{\pi \Phi_s}{\Phi_0}}{\frac{\pi \Phi_s}{\Phi_0}} \cdot \sum_{i=1}^m \frac{1}{\xi_s \left[\frac{1}{2} (x^{(i-1)} + x^{(i)}), y_s, z_s \right]} J_0 \left[\frac{2\epsilon V_{ro}}{\hbar\omega_s} \xi_s \left(\frac{1}{2} (x^{(i-1)} + x^{(i)}), y_s, z_s \right) \right] \right|. \quad (25)$$

Equation (25) shows that if the spatial modes of the electromagnetic radiation emitted from the $x^{(1)}$ to $x^{(i-1)}$ section of the junction do not match the spatial modes of the feedback radiation of the cavity, then they do not match the spatial modes from other parts of the junction. For the whole junction there would not be an H value at which the spatial field due to current in the junction matches the eigen field of the resonance cavity. Therefore, there will be no step jumps on the V_{ro} versus H curve of the ΔI_s versus H curve.

Using the graphical method in Ref 3 to solve Equation (25), the right hand side is a sum of Bessel functions of m parameters

$$\xi_s \left[\frac{1}{2} (x_{i-1} + x_i), y_s, z_s \right]$$

and is drastically different from a single Bessel function. As a result, there is no intersection with the hyperbola $y = V_{ro}^2$ and there is no value of H at which the i th cycle of the Bessel function is tangent to the curve and the $(i + 1)$ th cycle crosses the curve. V_{ro} is therefore continuous and has no jumps.

2. The quality factor Q

As can be seen in Figures 1 and 2, the amplitude V_{ro} of the feedback field increases as Q increases and the corresponding current jump decreases. As Q increases, the loss of the cavity decreases and the energy emitted from the excitation source increases the eigen oscillations and V_{ro} of the cavity.

To explain the decrease in ΔI_s as Q increases (see Figure 2), we use the explicit expression of a small junction.

The expression, given in Reference 2, is

$$\Delta I_s = I_s \left| \frac{\sin(\pi\Phi_s/\Phi_0)}{(\pi\Phi_s/\Phi_0)} J_n \left(\frac{2eV_s}{h\omega_r} \right) \right|. \quad (26)$$

For large Q , say 1,000 or greater, Figure 1 shows that $2eV_{ro}/h\omega_r > 10$ and the Bessel function of Equation (26) may be represented by its asymptote.

For $n = 1$,

$$J_1(x) \approx \sqrt{\frac{2}{\pi x}} \sin\left(x - \frac{\pi}{4}\right). \quad (27)$$

Using (27), (26) may be written as

$$\Delta I_s \propto \frac{1}{V_s^{1/2}} \sin\left(\frac{2eV_s}{h\omega_r} - \frac{\pi}{4}\right). \quad (28)$$

Since the sine function in (28) is always less than 1, ΔI_s decreases as V_{ro} increases. Similar to ordinary microwave radiation, an increase in the external radiation power suppresses the steps in the super current.

3. Lead position

From Equation (23), we know that $V_{ro} \neq 0$ when $\oint \left[\frac{1}{2} (x_1 + x_2), y_1, z_1 \right] = 0$, or when the lead is at a node. As pointed out in Ref 1, $M_r = \int \mathbf{E} \cdot d\mathbf{l}$ is a quantity dependent on the mutual inductance between the excitation circuit and the r th eigen mode of the cavity. At a node the spatial component of the eigen mode is zero and the mutual inductance is naturally zero. It follows from Equation (12) that the electric field E is zero and V_r is therefore zero.

IV. Conclusion

In this paper we have shown theoretically that, for a large Josephson junction situated in a resonance cavity and at the Josephson frequency $\omega = 2eV_0/h$, the amplitude V_{ro} of the feedback radiation at the junction will be modulated by the external magnetic field H and the step current ΔI_s changes with H . However, the V_{ro} versus H and ΔI_s versus H curves, unlike those in Ref 2, do not exhibit multiple steps within one flux quantum ϕ_0 . The reason is that the spatial component of the electromagnetic radiation from the large junction cannot match the spatial component of the eigen oscillation modes of the cavity.

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9698

CSO: 4008/258

APPLIED SCIENCES

BRIEFS

SINGLE-BOARD MICROCOMPUTERS--The design of the ICC industrial control single-board microcomputer designed by the Computer Department of the China University of Science and Technology and produced by the Bengbu Wireless Plant No 2 has been finalized and it has gone into production. In addition to having the functions of the Z-80 single-board computer, this computer has a Z-80A CPU, an A/D, D/A converter and eight I/O serial and parallel interfaces. The computer is equipped with four keys and 10 control commands especially for industrial control. It has wait, input, output, repeat, compare, search directory, jump, modular move and switch interrupt functions, the 10 commands can be combined in any fashion to form a command string to carry out a variety of functions, and it has self-checking functions; it is not necessary to write one's own programs for data acquisition. The current price of the computer is 1,200 yuan. [Text] [Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9, 8 May 84 p 7] 8226

SINGLE-BOARD COMPUTER USED TO CONNECT DISTANT TERMINALS--The Wuhan Railway Electronics Subcenter developed an encoding/rate converter using a ZD-065 single-board computer and used it so that a remote teletype could be linked directly by modem and the automatic phone circuits to the electronic computer center's computer so that it became a remote terminal of the computer. This terminal can carry out such computer operations as terminal registration, file set-up, file revision, file erasure, setting up original files, starting programs, and printing results. This converter device was tested in the 5 km area between the Wuchang Station and the Wuhan Railway Electronics Subcenter with satisfying results. The Wuchang Station directly used the computer of the Wuhan Railway Electronics Subcenter over a model 55 teletype. This greatly economized on investment and improve the use rate of the computer and the telephone circuits. [Text] [Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 9, 8 May 84 p 8] 8226

MICROCOMPUTER APPLICATION IN BUDGET PREPARATION—The Changchun Municipal Architectural Engineering Company No 3 and the Julin Institute of Technology formed a joint venture to develop a computer management system using CROMEMCO microcomputers; the system was designed to prepare architectural engineering budget with all Chinese character output capability. Recently, it passed evaluation by the Provincial department concerned. This joint venture provided a new approach for extended use of microelectronic technology in industrial business management. The use of microcomputers to prepare an engineering budget with Chinese character output has the following advantages: high speed, high efficiency, high accuracy, complete data storage capability, integrated results, easy interpretation, and ease of operation. The results are presented in Chinese characters directly without having to translate from numerical code. This not only reduces the amount of manual labor involved in preparing the engineering budget, but also allows many basic data analysis tasks which would be difficult to perform by manual means such as calculating the manpower and material requirements for each task and for each square meter, and the cumulative labor and material requirements. Based on the calculated results, one can use microcomputers to estimate the budget of over 220 individual items including construction, electricity, heat. It takes only 6 hours to complete the calculation of more than 5,000 pieces of data with no error, which is 30 times more efficient than manual computation. /Text/ /Beijing JINGJI RIBAO in Chinese 19 Jan 84 p 1/ 3012

STEEL MILL MANAGEMENT VIA COMPUTER APPLICATIONS--With the support of concerned units and after 1 year of experimental research, the Dalian Steel Plant successfully completed two scientific projects dealing with the application of computers in industrial management: "Construction of Static Commodity Input-Output Tables," and "Optimization of Production Structure." The research work of "Construction of Static Commodity Input-Output Tables" was done by joint efforts of research groups from the Dalian Steel Plant, and the Liaoning College of Finance and Economics organized by the Dalian Municipal Science Committee. From July 1982 to March of last year, they collected a large amount of data and began systematic classification of the data; they also wrote computer programs and obtained assistance from the Dalian Shipyard to carry out computations involving large matrices which could not be handled on a small computer. The method was to construct the 1983 material supply plan, which resulted in increased economic benefits and reduction in purchasing funds of 7.5 million yuan. The research work of "Optimization of Product Structure" was initiated jointly the Dalian Steel Plant and the Department of Applied Mathematics of the Dalian Institute of Technology. Since May 1982, they had devoted several months of efforts in field investigation, information gathering, design selection, software development and carrying out numerical calculations on the computer, resulting in the selection of five optimization schemes. Last year, application of these schemes in adjusting production structure produced a direct profit of 5.7 million yuan. /Text/ /Shenyang LIAONING RIBAO in Chinese 18 Jan 84 p 2/

CSO: 4008/144

LIFE SCIENCES

ZHANG JINGFU STRESSES DUST, POISON PREVENTION

OW081225 Beijing XINHUA Domestic Service in Chinese 1308 GMT 7 May 85

[By reporter Yang Like]

[Text] Beijing, 7 May (XINHUA)--Speaking at a national conference on the prevention of dust and poisons which ended today, Zhang Jingfu, state counsellor and chairman of the National Committee on Safety in Production, emphatically pointed out: Accidents involving injuries and deaths and dust and poison hazards are still rather serious in enterprises; they are incompatible with the excellent situation. Instead of just shouting slogans, it is necessary to strive to achieve actual results in ensuring safety and the health of staff and workers.

Zhang Jingfu said: In implementing the economic responsibility system, it is necessary to pay attention to safety, sanitation, and dust and poison prevention and regard them as important contents of the system. It is also necessary to maintain a cool head and firmly oppose the tendency of pursuing profits and a high growth rate at the expense of people's lives. An enterprise with a serious accident record should not be called an advanced enterprise no matter how fast its growth rate. It is necessary to change the attitude of paying attention to safety in production and dust and poison prevention only immediately after an accident occurs and neglecting such work at other times. While formulating, reviewing, and approving plans for capital construction and investment, planning departments must, from now on, include measures for dust and poison prevention and safety. Economic administrative departments must ensure that technological transformation of existing enterprises will help solve the problems of eliminating dust and poison hazards and ensuring safety in production.

Zhang Jingfu urged departments concerned to ensure that enterprises use funds for improving working conditions according to state regulations instead of diverting them to other purposes. It is necessary to adopt effective measures to strengthen the work of preventing dust and poisons and ensuring safety in production. Accidents caused by negligence of duty must be investigated and duly handled and should not be treated lightly. Since the founding of the country, all trades and professions have scored fairly good achievements in dust and poison prevention, and a number of advanced units have emerged in this regard. Experience shows that so long as leaders pay keen attention and

adopt effective measures, dust and poison hazards can be controlled and prevented. The work of preventing dust and poisons is an important matter having a bearing on the people's lives and property and the country's honor. People's governments at various levels and leading comrades of all departments concerned must pay close attention to this matter.

The national conference on dust and poison prevention was called by the National Committee on Safety in Production, the State Economic Commission, the Ministry of Labor and Personnel, the Ministry of Public Health, and the All-China Federation of Trade Unions.

Comrade Yuan Beohua made a summing-up speech at today's session.

CSO: 4008/337

LIFE SCIENCES

MEDICAL, PUBLIC HEALTH WORK IN MINORITY AREAS

HK080949 Haikou Hainan Island Service in Mandarin 0400 GMT 7 May 85

[Text] The Ministry of Public Health, the Guangdong Provincial Public Health Department, the Hainan Administrative District People's Government, and the Hainan Li-Miao Autonomous Prefectural People's Government have decided through consultation that from this year to 1989, each of them will appropriate a special fund of 1 million yuan, totaling 200 million yuan, to develop medical and public health work in the autonomous prefecture.

Since liberation, medical and public health work in the autonomous prefecture has quickly developed. Some infectious diseases and frequently-occurring diseases have been basically controlled and the level of health of people of all nationalities has been gradually raised. However, due to historical reasons, the situation in the shortage of doctors and medicines has not basically changed.

Last December Cui Yueli, minister of public health, and responsible comrades of the Provincial Public Health Department, the Hainan Administrative District People's Government, and the Autonomous Prefectural People's Government went deep into villages of Li Nationality and stockaded villages of Miao nationality in the Wuzhi mountain areas to investigate in detail the stage of medical and public health, studied and formulated a plan for developing medical and public health work in the places of minority nationalities, and decided to carry out the plan.

These special funds must be mainly spent on training medical personnel, replacement of medical equipment, and construction of hospitals. The public health departments in Tongza area, Sanya City, and Dongfang County must be regarded as the key points with due consideration for the other counties. At present, the autonomous prefecture has set up a funds use management group and has worked out a plan for using the funds.

CSO: 4008/337

LIFE SCIENCES

SHANGHAI MOBILIZES TO BATTLE DENTAL CAVITIES

0W131008 Beijing XINHUA in English 0830 GMT 13 May 85

[Text] Shanghai, 13 May (XINHUA)--Over 80 percent of children under the age of 6 in Shanghai suffer from dental caries, according to a general survey announced here today.

The survey says that one-third of the city's adults are victims of the disease.

To tackle this problem, the city's health department has organized 60 mobile teams with 200 dentists to carry out a complete treatment campaign.

The local government bears part of the expenses.

The city has 11 dental institutes, and all 200 general hospitals have dental departments. But they are still not enough to care for the populace of about 12 million, according to dentist Qiu Zhifang, a member of the Shanghai Society of Stomatology.

A documentary on dental hygiene is being shot jointly by the Shanghai scientific and educational film studio and the health department.

According to an earlier report, among China's 1 billion population, there are 400 million people suffering from dental caries. The World Health Organization has listed the disease as the third-most serious public health problem.

CSO: 3010/140

LIFE SCIENCES

MILITARY SYMPOSIUM ON MICROCIRCULATION SUMMARIZED

Beijing JIEFANGJUN YIXUE ZAZHI [MEDICAL JOURNAL OF CHINESE PEOPLE'S LIBERATION ARMY] in Chinese No 1, 20 Feb 85 pp 69-72

[Summary compiled by Zhao Kesen [6392 0344 2773], Military Medical College No 1: "Summary of Papers at the 1st Military Symposium on Microcirculation"]

[Excerpts] The First Military Exchange Symposium on Microcirculation was convened from 6-11 Aug 1984 in Lanzhou. A total of 77 representatives from all military units engaged in microcirculation research work participated in the conference. The conference received 111 papers altogether, divided into 3 categories for report and discussion: 1) microcirculation in military medicine and traumatology; 2) microcirculation and internal disease; 3) microcirculation and preclinical medicine. There were also 12 centers that made addresses and reports on special topics, introducing domestic and foreign progress in microcirculation research. A brief summary of the major conference papers follows:

I. Microcirculation in Military Medicine and Traumatology

1. Roentgenopathy

The Military Academy of Medical Sciences reported on patterns of change in microcirculation that occur during intestinal roentgenopathy. They used optical and electron microscopy to observe and verify the aftereffects of high-dosage radiation above 1500 rads. The microcirculatory changes in intestinal villi can be divided into four stages: 1) Within 6 hours of irradiation micrangiial construction and diastolic abnormalities appear; 2) Between 6 and 24 hours, due to endothelial injury the cytoblasts and cytosomes of veinlet endothelia herniate into the vascular cavities and cause local obstructions to blood flow; 3) After 6-24 hours there is destruction and effusion through the vascular walls; 4) In 3 days the chroionic micrangiia drop off. Use of the ^{99m}Tc internal erythrocyte labeling technique verifies that there is a decrease in intestinal blood 3 days after irradiation, and this is consistent with a change such as shedding of micrangiia from the intestinal mucosa. Use of ^{125}I labelled protein verifies that in

the process of accumulating a 600-2,200 rad dose of radiation there are two cycles of fluctuation in the penetrability of the intestinal blood vessels. Determination of the cell count and oxygen content in the blood of a rat irradiated with 825 rads reveals that there is a post-irradiation process of thrombocyte depletion, general restraint or depletion of micrangiial erythrocytes and decline in the oxygen content of mesenteric venous blood.

Based on a method of composite integral values assigned for the states of microcirculatory change detected in vivo, under the optical microscope, under the electron microscope and in post-radiation vascular penetrability, the Military Academy of Medical Sciences divided the micrangiia of 20 organ tissues into 5 categories of radiation sensitivity: 1) ultrasensitive: bone marrow blood sinuses; 2) highly sensitive: lymph capillaries, chrionic micrangiia of the small intestine and so forth; 3) sensitive: blood capillaries of the lymph nodes, spleen and bone marrow; 4) slightly sensitive: blood capillaries of the lungs, liver and skin; 5) low sensitivity: blood capillaries of the brain and testes. The 4th Military Medical College reported on dynamic changes in the ultrastructural organization of rat intestinal mucosa after large doses of radiation. They pointed out that disruptions in the restoration of intestinal gland somatic cells are closely associated with changes in the surrounding environment, particularly in the micrangiia, and the formation of deformed cells also is associated with changes in microcirculation. An injection of Radix Salviae Miltiorrhizae has an ameliorative effect on mesenteric microcirculation in irradiated rats. After treatment the caliber of blood vessels basically approaches normal and the rate of blood flow is somewhat improved. The 1st and 3d day declines in the percentage of surviving intestinal glands, the intestinal gland cell counts and the quantity of dividing cells are as slight after this treatment as they are in the control group, and on the 5th day after irradiation the pickup in the above indicators surpasses that of the control group. These facts all illustrate that improvement in the state of microcirculation plays a major role in promoting the restoration of proliferation in intestinal gland cells and in aspects of the treatment of intestinal roentgenopathy. The 4th Military Medical College also reported cardiovascular function changes in rats suffering from various types of roentgenopathy. They used 6 Gy of ^{60}Co gamma-rays in a single total irradiation to cause hematopoietic roentgenopathy. Intestinal roentgenopathy appeared after 20 Gy, cardiovascular roentgenopathy appeared after 200 Gy, and cerebral roentgenopathy appeared after 399 Gy. This work supports the notion that "cardiovascular roentgenopathy" occurs between "intestinal" and "cerebral" roentgenopathy, and it also examines the role of radiation damage to the cardiovascular system in the various types of roentgenopathy.

2. Trauma, Blood Loss and Shock

Chengdu Military Region General Hospital conducted an electron microscopic observation of the intestinal walls and the functioning of

mesenteric micrangiia and thrombocyte extension in dogs suffering from shock due to blood loss. They found that, during shock, the denatured swelling of blood capillary endothelia and their extension like pseudopodia into the vascular cavities, causing stenosis of the vascular cavities, may bring erythrocytic aggregation and minute thrombosis. Under the electron microscope 6 forms of thrombocytic extension can be seen: round, dendron, transitional, flattened, disintegrated and aggregate. Normally the round form is in the majority, but during shock the total number of thrombocytes decreases and round thrombocytes are sharply curtailed. Meanwhile dendron and aggregate forms increase distinctly, indicating the increased clumping tendency of thrombocytes. After volume expansion with an anti-shock solution, the proportion of round forms rises again and dendron and aggregate forms clearly decrease by comparison with their shock levels, though their proportion remains higher than pre-shock levels. This illustrates that infusion volume expansion can decrease thrombocyte surface activity and clumping tendency, bringing remission of the high state of hemagglutination. However, there is also a post-treatment increase in disintegrated thrombocytes thought to be associated with hemodilution and oxygen consumption. Consequently, it is suggested that there be a certain limit to the use of acellular fluid as a substitution for general resuscitation in order to avoid any disruption of the coagulant mechanism.

The Guangzhou Military District School of Military Medicine reported on microcirculatory changes in the intestinal walls of dogs and rabbits suffering from acute blood-loss shock. They observed the association between blood pressure changes during shock and microcirculatory changes in the intestinal walls. They suggested that blood pressure changes basically parallel microcirculatory changes in the viscera (intestinal walls). Arteriotomy can still be regarded as a reliable indicator for determining the degree of shock. The Wujing Jiangxi General Unit Hospital observed microcirculatory changes in the omentum majus of dogs during shock arising from occlusion of the mesenteric arteries. They found that dilation of the minute arteries and veins of the omentum majus occurs during the early, middle and late stages of shock and that retarding this dilation should be emphasized.

The 1st Military Medical College reported the effects of naluo tong naloxone [4780 3157 7904] on microcirculation in severe shock due to blood loss. They reverified work done by workers under the guidance of Professor Zweifach at the University of California, namely, that during severe, irreversible shock due to blood loss, there is a stage after reinfusion of blood when blood pressure picks up but microcirculatory blood flow cannot be completely restored. The possibility of restoring microcirculation directly affects the animal's chance of survival. Workers adopted a new research technique using a pair of simultaneously recording cameras, and found that after administration of naloxone and a blood transfusion the blood pressure rises steadily and pulse pressure increases distinctly. In the wake of pulse pressure

fluctuations there occurs hemocytic stasis and obstruction as the pulsating blood flow collides with the blood capillaries. This ultimately causes the blood capillaries to open and the blood flow is restored, notably increasing the animal's chances of survival. In turn, this verifies that micrangiia impacted due to hemocytic (particularly leukocytic) stasis may be one reason for incomplete post-transfusion restoration of microcirculation. Naloxone is an endorphine antagonist agent, and we know that its effect is to strengthen heart contractions in animals suffering from shock. Its injection in combination with a transfusion can notably increase an animal's chance of survival. This illustrates the major role that the interaction of endorphine release and microcirculatory factors play in severe, irreversible shock due to blood loss. In addition, this suggests an effective path to clinical treatment of severe shock.

The 3d Military Medical College reported on the association between renal ultrastructural organization, the state of hemagglutination and renal microcirculatory changes during acute crush renal failure syndrome. The use of radioactive renal charting indices and creatinine clearance determination verifies that after an animal displays acute crush renal failure syndrome the glomerular filtration rate declines distinctly. The electron microscope observes endothelial tumefaction of the glomerular micrangiia, vacular degeneration and plasmin herniation into the vascular cavities creating micrangiial stenosis or obliteration. This suggests that changes in glomerular ultra-structure and disturbances of glomerluar microcirculation are the major cause leading to a decrease in glomerular filtration rate and the occurrence of the syndrome. An assay of the state of high hemagglutination 1-5 days after the crush leads to the conclusion that the release of histothrombin brings about an increase in the coagulability and viscosity of the blood, aggravates microcirculatory disturbances and is one of the factors in the occurrence of the disease.

The Logistic School of Military Medicine observed changes in mesenteric microcirculation during balanced saline solution volume expansion treatment for shock. They found that after the infusion of the balanced solution in a quantity 6 times that of the blood lost, arteriotomy can be rather quickly restored, the output of urine is initiated, the restoration of microcirculatory flow is accelerated and this brings depolymerization of erythrocyte clumps and remission of the phenomenon of leukocyte adhesion to vascular walls. Hospital 81 reported on volume expansion treatment for 150 cases of traums shock and proposed that this be used in the early stages, in controlled quantities and rapidly.

3. Burn Injuries

The 2d Military Medical College used a laser Doppler microscope to observe the effects of Rhizome Ligustici Chuanxiong on mesenteric microcirculation in white rats after scalding. They confirmed that the substance does not have a significant effect on the caliber of

arterioles and veinlets. However, it can slow micrangiial blood flow and alleviate the degree of intermittent arrest and flow, it distinctly prolongs the average period of arrested blood flow and it has a particularly obvious stabilizing effect on blood flow in veinlets.

The 1st Military Medical College reported the results of electron microscopic examination of changes in dermal micrangiia in cases of burn injury. In their preliminary work they reconfirmed that there are two types of reaction in dermal micrangiia after a burn injury: one is the vasoconstriction reaction, in which thrombus easily forms and there is complete dermonecrosis; the other is the vasodilation reaction, in which thrombosis is minimal, there is partial dermonecrosis and a second-degree burn forms. The use of Rhizoma Polygoni Cuspidati No IV crystals can change the constriction reaction into a dilation reaction, consequently reducing thrombosis and alleviating the severity of the burn. In electron microscopic research it was found that after a burn injury the vascular basal membranes thicken, blur and fragment and the vascular endothelia swell, degenerate and partially drop off. This makes the inner surface rough and uneven, leukocytes and thrombocytes aggregate near the vascular walls and cracks appear between the endothelial cells. This research has provided the ultrastructural foundation for an inquiry into the causes of thrombosis and increased vascular penetrability after burn injuries.

The 2d Military Medical College reported on changes in pulmonary microcirculation in rabbits after scalding and intravenous injection of oleic acid. They found that scalding and oleic acid injections both can induce brief constriction in the pulmonary blood vessels and later occurrences of congestion and ecchymoma. In addition, two different types of pulmonary edema--alveolar edema and interstitial pulmonary edema--can be seen.

4. Other

The conference received papers on *Hyoscyamus niger* pharmacotherapy for trauma and shock. Hospital 280 used the compatible drugs scopolamine and chlorpromazine in surgical anesthesia on 120 shock patients. This has a dual function as a surgical anesthesia and a shock treatment, and it opens a way for prompt operations and removal of the *causa morbi* in shock patients. The Airforce School of Military Medicine reported that mountain *Hyoscyamus niger* can increase the number of open blood capillaries, accelerate blood flow and depolymerize erythrocytes in the soft tissues of a rat's fracture site, spurring local hematoma absorption and osteostylus formation. Hospital 254 and Hospital 280 separately reported that mountain *Hyoscyamus niger* has a fairly good curative effect on severe thrombophlebitis in the lower extremities. Hospital 280 used *Hyoscyamus niger* pharmacotherapy on cold injuries and found that it is beneficial in healing trauma and in tissue preservation.

II. Microcirculation and Internal Disease

Infectious Disease

The Beijing Military Region General Hospital, Hospital 254, Hospital 106, Naval General Hospital and Lanzhou Airforce Hospital reported on jiazhou nail [3946 4126] microcirculatory changes in hepatitis patients. Generally, during acute hepatitis the "spastic form" expression is dominant in jiazhou microcirculation, there is a decline in vascular ansa detail, input branches "have spasms," irregular vascular ansa proliferate and blood flow slows. In chronic hepatitis the "extravasted blood form" is dominant, blood is extravasted from the ansa verteces, output branches dilate and may hemorrhage and thelophlebostemma can be seen. The Naval General Hospital found that jiazhou microcirculatory changes in acute hepatitis are restored to normal following improvement in liver function. When lever function chemical examination recovers but jiazhou microcirculation is still not restored, it may indicate that the disease state is chronic and latent. In chronic hepatitis, jiazhou microcirculatory changes are not restored to normal as a result of improved liver function.

Hospital 302 reported on jiazhou microcirculatory changes in acute bacillary dysentery. They found early-stage vasodilation, increases in the length and diameter of vascular ansa and in the width of ansa verteces, and decreases in the speed of blood flow. At the climax stage the manifestations are of constricted micrangiia, and attenuated, narrowed, shortened vascular ansa. This hospital summarized their experience with treatment of 219 cases of toxic dysentery over the past 20 years. Since the adoption of complex therapy stressing 654-2, the case fatality rate has fallen distinctly: of the 219 cases a total of 20 have died, and all of these died in heteropathy and in pharmacotherapy for vasoconstriction.

Hospital 105 reported on jiazhou microcirculatory changes in 27 epidemic hemorrhagic fever patients. In the severe phase of the disease, the following changes are seen: jiazhou micrangiial ansa increase in thickness, the blood flow is slowed, there is hemocytic aggregation, a phenomenon of blood plasma separation from hemocytes occurs and the peripheral effusion from the vascular ansa forms a lunar aureolar shape. When the DIC occurs the majority of blood flow in the vascular ansa is in an arrested state. In the wake of fiber dissolution and stimulation, microcirculatory blood flow is progressively accelerated, the vascular ansa become more finely detailed, the exudate is absorbed and patients frequently hemorrhage at this time.

III. Microcirculation and Certain Problems in Preclinical Medicine

The Trauma Surgical Center of the People's Liberation Army School of Advanced Military Medicine presented their knowledge of hemorheology and their ideas on conjugated fibrin (Fn). They reported on the viscosity of whole blood, the aggregability of thrombocytes and changes

in antithrombin III in burn victims. They also reported on the Fn content in the blood of 82 healthy individuals and on changes in the blood plasma Fn of 14 patients after moderate surgery. They found that postoperative plasma Fn drops 8-51 percent and is generally restored by the 3d day after surgery. They suggested that observation of plasma Fn concentration is of major significance for the prevention of postoperative infection and incomplete pulmonary function. The Military Academy of Medical Sciences made a special report on quality control work in microcirculation observation methods. They presented diurnal changes in normal human jiazhou and bulbar conjunctiva microcirculation and methods for collecting complete information and obtaining accurate data. They also made a suggestion on quantitative analysis of jiazhou microcirculation. With respect to the 15 regular observation indices on jiazhou microcirculation, they assigned a "weight" value based on the pathophysiological significance of each index, and they assigned a "fractional" value based on the clinically observable degree of change in each index. The integral values can be obtained from the product of the "weight" value and the "fractional" value. The quantitative analysis of illness development and therapeutic effect is obtained from the "weight"-added integral value based on a composite quantitative analysis of jiazhou microcirculation.

With respect to microcirculation research in special arms of the service, the Guangzhou Airforce Hospital reported on observations of jiazhou microcirculation in 300 pilots. In normal pilots they found a rather high rate of irregular ansa and thelophlebostema, relatively slow blood flow and, in a minority, erythrocytic aggregation. It is considered possible that these factors are associated with flight conditions and a high-fat diet. Hospital 412 reported on microcirculatory changes in the bulbar conjunctive and fundus oculi of normal submarine personnel. They found capillary hemangioma appearing on the bulbar conjunctiva, deformed and crooked blood vessels, slow blood flow and nuzhang [1829 1728] of the veins in the fundus oculi. It is postulated that these changes are associated with the environmental effects in submarines of high temperature, high atmospheric pressure, strong light and noise.

12510
CSO: 4008/298

LIFE SCIENCES

BRIEFS

MEDICAL EXHIBIT IN CAIRO--Cairo, 6 May (XINHUA)--An exhibition of Chinese medical instruments and pharmaceuticals, the first of its kind in Egypt, opened in Cairo today. On display are about 200 items including microsurgical instruments, medical lasers, anesthesia apparatus and dental treatment systems. There are also more than 250 varieties of Chinese traditional and Western medicines including semi-synthetic antibiotics, and some drugs of Chinese medical herbs effective for specific diseases. Egyptian vice-minister of health, Dr Medhat al-Katan attended the opening ceremony of the exhibition, which was sponsored jointly by the Egyptian and Chinese companies concerned. [Text] [Beijing XINHUA in English 1503 GMT 6 May 85]

CHILDREN'S PHYSICAL SURVEY--Beijing, 11 May (XINHUA)--A sample survey of children's physical condition is to be made in 10 provinces and nine major cities, the Ministry of Public Health announced here today. It will check 400,000 under-eights for weight, height standing and sitting and circumference of head, shoulders and chest. The survey will start in late May and June in the provinces and cities and end in October, said the ministry's children's welfare section. The 200,000 in the provinces will come mainly from rural areas. This is China's first large-scale survey of rural children's physical condition. The same age group was surveyed in nine cities, including Beijing, in 1975. This year's data will be compared. The survey sites are spread evenly so as to be representative of China's 150 million children in this age group. [Text] [Beijing XINHUA in English 0827 GMT 11 May 85]

HUI NATIONALITY HOSPITAL--Xining, 12 May (XINHUA)--A Hui nationality hospital, first on the Qinghai-Tibet plateau, opened in this capital of Qinghai Province today. The hospital has 100 beds and medical, surgical, obstetrics and gynecology, [word indistinct], Chinese medicine and anal fistula departments. All doctors and nurses are of Hui nationality. Qinghai is inhabited by 600,000 Moslems, 150,000 of them being in Xining. This hospital is the fifth in China. The others are in Beijing, Tianjin, Luoyang and Xi'an. Mongolian and Tibetan hospitals have already been built in the province's six autonomous prefectures. The province boasts 553 hospitals and clinics in all towns. [Text] [Beijing XINHUA in English 0155 GMT 12 May 85]

PRC, ETHIOPIA MEDICAL AGREEMENT--Addis Ababa, 8 May (XINHUA)--Ethiopia and China signed an agreement here today on the assignment of a Chinese medical team to work in Ethiopia. Chinese ambassador Zhao Yuan and Dawit Getachew from the Ethiopian National Committee for Central Planning signed the agreement on behalf of their respective governments. In accordance with the plan, China will send a 15-member medical team to work in an Ethiopian hospital for 2 years. China has sent two medical teams to work in Ethiopia over the last 4 years. [Text] [Beijing XINHUA in English 1626 GMT 8 May 85]

ENVIRONMENTAL QUALITY

REGULATIONS ON DUMPING WASTE AT SEA PUBLISHED

Beijing ZHONGGUO HUANJING BAO in Chinese 23 Mar 85 p 3

[Text of the Regulations on Dumping Waste at Sea of the People's Republic of China]

[Text] Article 1 These regulations were drawn to carry out the "Marine Environmental Protection Law of the People's Republic of China," to strictly control waste dumping at sea, to prevent damage from pollution in the marine environment, to maintain the balance of ecology, to protect marine resources and to promote the development of marine enterprise.

Article 2 "Dumping" in these regulations means the use of boats and ships, aircraft, platforms and other transportation means to dispose of waste and other material at sea; to discard boats and ships, aircraft, platforms, and other man made marine structures at sea; and to dispose of the waste and other materials produced from the exploration and development of seabed mineral resources and from the marine processing activities related to exploration and development at sea.

The discharge of waste produced from normal operation of boats and ships, aircraft and other transportation means and equipment is not included in "Dumping."

Article 3 These regulations apply to the following:

1. Dumping waste and other material in the inland seas, territorial seas, continental shelf and other maritime space that belongs to the People's Republic of China.
2. For the purpose of dumping, loading waste and other materials in the land or sea ports of the People's Republic of China.
3. For the purpose of dumping, transport waste and other material through the inland seas, territorial seas and other maritime space of the People's Republic of China.
4. Burning waste and other materials in the maritime space under the jurisdiction of the People's Republic of China.

The waste produced from the exploration and development of offshore oil should be treated according to "the Regulations of the Environmental Protection and Control on the Exploration and Development of Offshore Oil in the People's Republic of China."

Article 4 The department responsible for the waste dumping at sea is the State Oceanography Bureau of the People's Republic of China and its agencies. (Called "responsible department" later.)

Article 5 The areas for dumping at sea are designated on the basis of a safe, economical and scientifically rational principle by the responsible department which discusses the issue with related departments. They then are approved and confirmed by the State Council.

Article 6 The unit that has a need to dump waste at sea should apply to the responsible department in advance, fill out an application form according to the prescribed format, and report the characteristics and compositional analysis of the waste.

The responsible department will examine and approve the application within 2 months after receiving the application form. It will issue a permit to those who are approved to dump waste.

Any unit, boat and ship, aviation apparatus, platform and other transportation means cannot dump waste at sea unless it obtains a permit from the responsible department.

Article 7 Foreign wastes are not allowed to be transported to the maritime space under the jurisdiction of the People's Republic of China and dumped at sea. These include abandoned boats and ships, aircraft, platforms and other man-made marine structures. Those violating the regulations will be asked by the responsible department to resolve the problem within a limited period of time, pay the clean-up fee, pay for the damage and also pay a fine.

Those dumping waste at sea outside the maritime space under the jurisdiction of the People's Republic of China, and causing polluting damage inside the maritime space under the jurisdiction of the People's Republic of China will be treated according to Article 17 of these regulations.

Article 8 For the purpose of dumping, any ship, boat or transportation means that transports waste through the maritime space under the jurisdiction of the People's Republic of China should report to the responsible department 15 days before entering the maritime space under the jurisdiction of the People's Republic of China. At the same time, it has to report the expecting entry date to the maritime space under the jurisdiction of the People's Republic of China, the route and the name, quantity and composition of the waste.

Article 9 Boats, ships and platforms of foreign registration in the maritime space under the jurisdiction of the People's Republic of China, because of the waste and other material produced from the exploration and development of

under-sea mineral resources and from marine processing activities related to the exploration and development at sea which have needs to dump them at sea, should follow the formulated process and apply for permits from the responsible department.

Article 10 A permit for dumping should specify clearly to which unit the permit is issued, its effective date and the quantity, category and method of dumping of its waste.

Permit issuance should follow the rules in these regulations and be controlled strictly. According to the change in the marine ecological environment and the development of scientific technology, the responsible department can replace or cancel a permit.

Article 11 The waste can be classified into three categories based on factors such as its toxicity, its harmful material content and its influence on the ocean environment. The standards for the classification were drawn up by the responsible department. The responsible department can revise the appendix according to changes in the marine ecological environment, the development of scientific technology and the need for marine environmental protection.

1. When waste and other material listed as material prohibited to be dumped at sea in Appendix 1 (see Appendix 1), in emergency cases, if disposed in land, will severely endanger the health of the population, then it is allowed to be dumped in a designated area according to the required method, provided that it was approved by the responsible department and obtained an emergency permit.
2. A special permit should be obtained before dumping waste that is listed in Appendix 2 (see Appendix 2).
3. A general permit should be obtained before dumping waste with low toxicity or non-toxicity which is not listed in Appendix 1 and Appendix 2.

Article 12 At the time of loading waste, the unit obtaining permission to dump waste at sea should notify the responsible department for confirmation.

The confirmation should be processed according to the items listed in the permit. If the responsible department discovers the actual load to not be consistent with the contents listed in the permit, it will order the loading process to stop, in severe cases, it shall suspend or revoke the permit.

Those using boats and ships to dump waste should notify the departing port or the closest harbor superintendency administration to check. If the harbor superintendency administration discovers the actual load to not be consistent with the contents listed in the permit, it should not issue a passing visa and should notify the responsible department without delay.

Article 13 The responsible department should supervise and monitor the sea dumping activity and send an inspector to come along if necessary. The dumping unit should provide conveniences to the accompanying government functionary.

Article 14 A unit having obtained the permit to dump waste at sea should dump the waste at the designated area within the limiting date and following the conditions indicated in the permit. It should fill in the dumping conditions form in detail on the spot and send the form to the responsible department according to the requirements indicated in the permit. The boats and ships, aviation apparatus, platforms and other transportation means should be equipped with distinctive marks and signals and the dumping conditions should be recorded in the logbook.

Article 15 The boats and ships, aircraft, platforms and other transportation means used if fitting into the conditions listed in item 43 of "Marine Environmental Protection Law of People's Republic of China" may not be held responsible for compensation.

Those dumping waste under conditions or in an area which is not indicated in the permit during an emergency in order to avoid danger or for life saving, should try their best to avoid or decrease the polluting damage caused by dumping, and report to the responsible department afterwards as soon as possible. The dumping unit and the beneficiary of the action or life saving emergency should make compensation for the polluting damage they create.

If a polluting damage is caused by a third party, the dumping unit should submit conclusive evidence to the responsible department. After confirming the evidence, the responsible department will order the third party to be held responsible for compensation.

If boats and ships, aircraft, platforms and other transportation means navigating or working at sea, dump waste due to insurmountable conditions, their owner should report it to the responsible department and the nearest harbor superintendency administration and retrieve and clean up the waste as soon as possible.

Article 16 The responsible department should monitor the dumping area regularly, strengthen the administration, avoid harmful damage to fishing resources and other marine activities. When a dumping area is discovered unsuitable to accept more waste, the responsible department may decide to close it.

Article 17 The responsible department will order those who violate these regulations and cause environmental damage in marine ecology to resolve the problem within a limited time. They will pay the cleanup expense, compensate the aggrieved party for the loss caused by the act and depending on the seriousness of the case and the extent of polluting damage, obtain a warning or a fine of less than 10,000 yuan.

Article 18 The unit or individual requesting a compensation for damage should submit a report of requesting compensation for polluting damage to the responsible department as soon as possible. The report should include the time, the place and the range of this polluting damage, a detailed list of the

damage, a technical appraisal and notary testimonial along with related original documents such as receipts, bills and invoices etc. and photographs if possible.

Article 19 After the clean-up, the unit which is commissioned to do the clean-up job should submit a bill for the clean-up fee. The bill should include the time; place; man power, machines and boats and ships used in the job; quantity, unit price and calculation method of material used in the clean-up; the management fee, the transportation fee and other related expenses in organizing the clean-up; the results and condition of the clean-up and other related evidence and identifying materials.

Article 20 The criteria for the punishment of unlawful practices are as follows:

1. Those guilty of one of the following actions will receive a warning or pay a fine of less than 2,000 yuan.
 - (1) Forge a waste inspection list.
 - (2) Fill out the dumping conditions form without following the rules set in Article 14.
 - (3) Fail to report promptly to the responsible department or harbor superintendency administration in the situation cited in Article 15.
2. When the actual content differs from that indicated in the permit, the party will, in severe cases, pay a fine between 2,000 and 5,000 yuan, and their permit will be suspended or revoked.
3. Those who do not follow the regulation in Article 12 to notify the responsible department to check and then proceed to dump wastes without authorization will pay a fine between 5,000 and 20,000 yuan.
4. Those guilty of one of the following actions will pay a fine between 20,000 and 100,000 yuan.
 - (1) Dump waste at sea without permission.
 - (2) Dump waste not following the conditions and area indicated in the permit. (The conditions cited in Article 15 of this regulation are not included.)

Article 21 The responsible department may issue a warning and/or impose a fine to the person who is directly responsible for violating these regulations and causing or possibly causing damage from marine environmental pollution.

The judicial organs will investigate the responsibility for crime of a person who is directly responsible for violating these regulations and causing severe financial loss or injury or death from polluting and damaging the marine environmental ecology.

Article 22 The party that does not concur with the punishment issued from the responsible department may appeal in the people's court within 15 days upon receiving the punishment notice. The responsible department will request the people's court to enforce the punishment to those that, after the expiration date, neither appeal nor carry out the punishment.

Article 23 Those who inform and expose any conduct that violates these regulations and causes damage from the marine environmental pollution and actively provide evidence on their own initiative, or take effective measures to decrease the damage from pollution will be praised and rewarded.

Article 24 These regulations come into force on 1 April 1985.

Appendix 1 Materials that are prohibited to dump:

1. Waste materials containing organic halogen compounds, mercury and mercury containing compounds and cadmium and cadmium containing compounds, except those with trace amounts of the material mentioned above, or those that can rapidly change into harmless materials in sea water.
2. Strongly radioactive waste and other strongly radioactive materials.
3. Crude oil and its waste, petroleum refining products, oil residues and mixtures containing those materials.
4. Synthetic materials such as fishing nets, ropes, plastic products and other materials which float or suspend on the surface of the sea, severely obstructing navigation, fishing and other activity or endangering marine organisms.
5. Sewage sludge and dredging material containing the materials mentioned in Nos 1 and 2 of this Appendix.

Appendix 2 Materials that require a special permit for dumping:

1. Waste materials containing large amounts of the following materials:
 - (1) Arsenic and its compounds;
 - (2) Lead and its compounds;
 - (3) Copper and its compounds;
 - (4) Zinc and its compounds;
 - (5) Organosilicon compounds;
 - (6) Cyanides;
 - (7) Fluorides;
 - (8) Beryllium, chromium, nickel, vanadium and their compounds;
 - (9) Insecticides and their by-products not mentioned in Appendix 1.

Except harmless materials or those that can rapidly change into harmless materials in sea water.

2. Waste materials containing weakly radioactive substances.
3. Containers which are liable to sink to the bottom of the sea and severely obstruct fishing and navigation, waste metals and other heavy waste materials.
4. Sewage sludge and dredging material containing the materials mentioned in Nos 1 and 2 of this Appendix.

12875

CSO: 4008/309

NITROGEN MIGRATION IN ZHUJIANG RIVER REPORTED

Beijing HAIYANG YU HUZHAO [OCEANOLOGIA ET LIMNOLOGIA SINICA] in Chinese
No 6, Nov 84 pp 515-520

[Article by Lin Zhiqing [2651 2784 7230] and Zheng Jianlu [6774 1696 4389],
both of the South China Sea Institute of Oceanology, Chinese Academy of
Sciences, Guangzhou; Zhu Jianhua [2612 1696 5478], Zhejiang University,
Hangzhou: "Nitrogen Migration in Zhujiang River"]

[Summary] The Zhujiang River (Pearl River) is the only tropic-subtropical
river of considerable magnitude in China. The study of the variation and
migration of nitrogen as a nutrient is one of the approaches to the under-
standing of substance exchange at the river-sea interface.

Measurements of the three states of N ($\text{NO}_3\text{-N}$, $\text{NO}_2\text{-N}$ and $\text{NH}_4\text{-N}$) in the Zhujiang
River basin from Guangzhou to Shanbanzhou Sandbank at the Zhujiang River mouth
were first carried out during the summer of 1982. Results were obtained of
N content variation and distribution patterns, the relationship of N with
environmental factors, and the correlation and transformation between
different states of N.

Nitrogen content in the Zhujiang River water is relatively high. Dissolved
inorganic N and $\text{NO}_3\text{-N}$ are 5.2 and 8.9 times those of the world rivers on the
average, respectively. It is estimated that flux of the three states of N
passing through the Humen Mouth might be 15.8 kg/s (by NO_3 weight).

The main sources of N are soil, industrial effluents, rotten crops and
agricultural fertilizers.

9717
CSO: 4009/108

SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

LI DESHENG COMMENDS PLA SEISMOLOGIST

OW081001 Beijing Domestic Service in Mandarin 2325 GMT 7 Apr 85

[Excerpts] Li Desheng and Liu Zhenhua of the Shenyang Military Region issued an order on 9 March to award the title of "Pacesetter in Achieving Competence Through Self-study" to Dong Haixiang, a clerical worker of a PLA regiment. Since his enlistment in 1968, Dong Haixiang persistently studied seismology on his own, strived to explore seismological secrets and used the knowledge he acquired through self-study to provide the state seismological departments with 13 forecasts on earthquakes at home and abroad. These forecasts were proven to be accurate. He also wrote more than 20 valuable theses including "Rainbow in a Clear Sky" winning wide acclaim from the departments concerned.

Dong Haixiang not only learned from books, but also gained practical experience. For the past 10 years or more, he has taken the opportunity to visit old and new quake-stricken areas in over 10 provinces and cities.

A medium-strong earthquake hit a certain area in southern China in early July 1979. Warning signs were quite prominent during this earthquake. With the leadership's approval, he visited this area and gathered first-hand information. Later, he again visited the Nanjing Seismological Station to study the record of the warning signs. Even more commendable was the fact that he always sought advice from professionals and experts on seismology such as Lu Daxiong and Li Yongkun and others to tackle difficult problems and continually broaden his knowledge.

On the evening of 6 July 1978, Dong Haixiang wrote a letter to the state Seismological Bureau forecasting that in 9 days a strong earthquake would hit the coastal area in southeast China and the vicinity of Taiwan. Nine days later, a strong earthquake of 7.4 magnitude hit Taiwan. The time of the earthquake and the time in the forecast were only 3 hours apart.

Dong Haixiang said: The study of clouds in forecasting earthquakes is only one aspect of seismology. We still have a great deal to learn in this respect. Now Dong Haixiang, an expert through self-study, has been elected vice chairman of the board of directors of the Liaoning Provincial Association for the Study of Earthquake Clouds and deputy executive chairman of the Society for the Study of Earthquake Warning Clouds.

Although he shoulders heavy tasks, Dong Haixiang remains clear-headed at all times. He said: For people's lives and property, I am determined to continue studying and exploring and to make contributions to providing accurate earthquake forecasts.

CSO: 4008/320

SCIENTISTS AND SCIENTIFIC ORGANIZATIONS

INTRODUCTION TO MICROCOMPUTER USERS GROUPS

Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese Extra No 1,
29 Apr 84 p 18

[Article: "Introduction to Microcomputer Users Groups"]

[Text] With the rapid spread of microcomputers, microcomputer users organizations have been established in trades, professions and regions. These groups play a positive role in consulting service, technical training, exchange of experience, and cooperative development and they promote the popularizing and application of microcomputers. To facilitate discussion of problems and exchange of experience between microcomputer users groups and to reduce the duplication of effort, we are printing some of the information we have collected on national microcomputer users groups to make it easier for everyone to get in contact with these groups. Since our information is not complete and the situations change very rapidly, there are bound to be some gaps. We hope that concerned groups will get in touch with us so that we can introduce them to our readers in the future.

China Computer Users Association:

This association was established in 1983 and its registered affiliation is in the China Computer Technology Service Company. The current president is Ma Fuyuan [7456 4395 0337], advisor is Chen Liwei [7115 0500 3634], and secretary is Cao Changjiu [2580 7022 0036]. Below are some of the subordinate associations of this association concerned with microcomputers.

Beijing Association, registered affiliation, the Academy of Sciences, Electronics Institute, contact persons are Feng Guoye [7458 0948 0396] and Dong Tao [5516 7118].

Shanghai Association, registered affiliation, Shanghai Computer Applications Service Department, contact person is Wang Shougen [3769 1108 2704], publication DIANNAO YINGYONG SHIDAI [COMPUTER APPLICATIONS ERA].

Central China Association, registered affiliation, Computer Department of Wuhan Central China Industrial College, contact persons are Zou Haiming [6760 3189 2494] and Wang Shunhai [3769 7311 3189], publication YINGYONG JIANXUN [APPLICATIONS NEWSLETTER].

North China Association, registered affiliation, Tianjin Branch of the China Computer Technology Service Company, contact persons are Li Defang (2621 1795 6078) and Geng Jiru (5105 4949 0320), publication XIEHUI JIANXUN (ASSOCIATION NEWSLETTER).

Northeast Association, registered affiliation, Shenyang Automation Institute of the Academy of Sciences, contact persons are Yin Chaowan (1438 2600 8001) and Hu Baoquan (5170 1405 3123).

Southwest Association, registered affiliation, Department Eight, Chengdu Telecommunications Engineering College, contact persons are Yang Xuming (2799 2485 2494) and Xu Yongshu (1776 3057 1659), publication YINGYONG WENJI (APPLICATIONS COLLECTION).

East China Association, registered affiliation, Jiangsu Branch of the China Computer Technology Service Company, contact persons are Zhang Xilong (1728 6932 7893) and He Lianjuan (0149 5571 1221), publications JISUANJI JISHU (COMPUTER TECHNOLOGY) and JISUANJI SHIDAI (COMPUTER ERA).

Northwest Association, registered affiliation, Xian, Post Office Box 85, Room 2, contact persons Hui Yuannian (1920 6678 1628) and Han Chunxuan (281 2504 6693).

TRS-80 Microcomputer Association, registered affiliation, Guangzhou Sun Yatsen University Computer Station, contact person is Li Yubiao (2621 3768 2871).

ZD Series Chinese Character Terminal Association, registered affiliation, North China Terminal Equipment Company, Baoding, Hebei, contact person is Zheng Kuiying (6774 7608 5391).

Microcomputer Development Systems Association, registered affiliation, Shanghai Computer Applications Service Department.

Pingguo Association (Proposed), registered affiliation, Weifang Computer Plant, Shandong, contact person is Feng Weichuan (7458 3262 1557), publication PINGGUOYUAN (APPLE ORCHARD).

Yingteer (5391 3767 0334) Computer Association (Proposed), registered affiliation, Great Wall Machine Plant, Beijing, contact person is Qi Xilin (4847 1585 2651).

China Microcomputer Applications Association

This association was founded in 1981 and is a second-level society subordinate to the China Management Modernization Society, and with registered affiliation in the Ministry of Machine Building. The association has a secretariat (at Hunan University in Changsha), an exchange department (at Acoustics Institute Lab No 5, Beijing Institute of Remote Sensing, Academy of Sciences), a consulting department (at the Institute of Computers, Academy of Railway Sciences, Beijing), and a scholarship committee (at the

Institute of Automation, Ministry of Machine Building, Beijing), and a new technological development department (at the Xiamen Institute of Electronics). The specialized committees of the association are: Industrial Control Committee (at Department Three, Shanghai Jiaotong University), Chinese Character Information Committee (at the Shanghai Institute of Instrumentation); planned committees include: Intelligent Instrument Committee (at the Chongqing Institute of Automated Industrial Instrumentation) and a Microcomputer Management Committee (at the Institute of Automation, Ministry of Machine Building Industry, Beijing).

The association publishes the quarterly WEIJISUANJI YINGYONG (MICROCOMPUTER APPLICATIONS), the quarterly WIXING DIANNAO (MICROCOMPUTER), and the bimonthly WEIXING DIANNAO YINGYONG WENZHAI (MICROCOMPUTER APPLICATIONS DIGEST). In addition, it publishes the biennial ZHONGGUO WEIJISUANJI YONGHULU (CHINA MICROCOMPUTER USER REGISTRY).

Every 2 years the association holds a comprehensive scholarly exchange meeting and at the same time holds a microcomputer exhibit. The second academic exchange meet is planned for this November in Xiamen.

The association's current president is Yang Shiren (2799 0013 0086), Deputy Director of the Institute of Remote Sensing of the Academy of Sciences, and the secretary is Zhou Jiwu (0719 4949 2976) of Hunan University.

Branch associations are as follows:

Chengdu Branch, registered affiliation, Chengdu University of Science and Technology

Wuhan Branch, registered affiliation, Hubin Instrument Plant, Wuhan

Chongqing Branch, registered affiliation, Chongqing University

Shanghai Branch, registered affiliation, Shanghai Jiaotong University

Fujian Branch, registered affiliation, Fujian Computer Plant

Jiangsu Branch, registered affiliation, Nanjing Institute of Automation, Ministry of Water Resources and Electric Power

Beijing Branch, registered affiliation, Beijing Industrial University

Guizhou Branch, registered affiliation, Guiyang Institute of Electrical Engineering

Kunming Branch, registered affiliation, Yunnan Electronics Equipment Plant

Jinan Branch, registered affiliation, Shandong University

Lanzhou Branch, registered affiliation, Gansu Industrial University

Microcomputer Research and Applications Association

(formerly the Z-80 Microcomputer Users Association)

This association was established in 1981 and changed its name in 1983. Its registered affiliation is Beijing Industrial University. Its honorary president is Xu Zhengchun (1776 2973 2506), advisors are Wei Yonghe (7614 3057 0735) and Zhang Haiquan (1728 3189 3123), president is Yang Xiwu (2799 1585 2976), Director of the Scientific Research Office of Beijing Industrial University, vice president and secretary is Dong Changling (5516 2490 3249), Deputy Chairman of the Computer Department of Beijing Industrial University. The association publishes WEIJISUANJI YANJIU YU

YINGYONG (MICROCOMPUTER RESEARCH AND APPLICATIONS). The association's branch groups are as follows:

Zhejiang Branch (registered affiliation unit: Zhejiang Computer Institute, Hangzhou, contact person: Wang Longqiu (3769 7893 4426))
Shanghai Branch (registered affiliation unit: P.O. Box 20, Shanghai Jiaotong University, contact person: Wang Jiawei (3769 1367 0251))
Shaanxi Branch (registered affiliation unit: Shaanxi Science and Technology Commission, Xian, contact person: Wang Shouzhi (3769 1343 2535))
Gansu Branch (registered affiliation unit: Institute of Chemical Biology, Chinese Academy of Sciences, Lanzhou, contact person: Sun Laicheng (1327 0171 2052))
Southwest Branch (registered affiliation unit: Shuanglong Bridge Electronic Computer Center, Kunming, contact person: Lai Zuxi (6351 4371 3356))
Hebei Branch (registered affiliation unit: Hebei Science and Technology Commission, Shijiazhuang, contact person: Ma Weimin (7456 3634 3046))
Metallurgy Branch (registered affiliation unit: Computer Lab, Beijing College Road Metallurgy Construction Research Institute, contact person: Zhang Wei (1728 0251) and Li Teqi (2621 3676 1142))
Loyang Branch (registered affiliation unit: Loyang Tractor Institute, Henan, contact person: Fu Dajun (0265 1129 6874))

Microcomputer Applied Technological Coordination Group of the Chinese Academy of Sciences

This association was founded in August, 1982. Over 100 Academy units belong to the association. The association presidency is held by Jiang Shi (unreadable) (5592 1102 XXXX), Wu Jikang (0702 0415 1660) and Cao Jinhuan (2580 6930 3562) are advisors to the association; the secretarial unit is Lab No 3 of the Scientific Instrument Plant (P.O. Box 2724, Beijing), the responsible person is Jin Yanjing (6855 3601 7235). The association's publication is C YINGYONG JISHU (C APPLICATIONS TECHNOLOGY). The associations regional organizations are as follows:

Name	President's Unit	Convenor
Capital Club (includes North China)	Institute of Electrical Engineering	Wan Yuliang (8001 6657 5328)
Northeast Club	Shenyang Institute of Computers	Luan Guixing (2940 6311 5281)
East China Club	Shanghai Metallurgical Institute	Ying Mowu (2019 2875 5294)
South Central Club	Wuhan Institute of Physics	Feng Gongqi (7458 0501 0796)
Southwest Club	Chengdu Computer Applications Institute	Liang Mingjiang (2733 6900 6973)
Northwest Club	Xinjiang Institute of Physics	Shen Lansun (3088 5695 5549)
Instrument Intelligent Club	Beijing Scientific Instrument Plant	Yan Rencong (0917 0088 1922)

Experimental Auto- mation Club	Shanghai Biology Institute	Chen Junqiang [7115 0193 1730]
Management Computer Club	Academy of Sciences Computer Center	Tang Yousan [0781 2589 0005]
Microcomputer Systems Club	Academy of Sciences Computer Institute	Han Chengde [0281 2110 1795]
Software Exchange Station (responsibility of the secretariat unit)		

**Microcomputer Specialized Information Network of the Ministry of Electronics
Industry**

This information network was established in March, 1982 and is made up of microcomputer research, design, and production units and some educational and applications units, its membership currently numbers over 160 units. The information network was established in the Ministry of Electronics Industry's Electronics Technology Applications and Promotions Institute (P.O. Box 927, Beijing), network head: Gong Bingzheng [7895 3521 6927], standing secretary: Dong Jiajing [516 1367 2417]. The information network's publication is WEIXINGJI YU YINGYONG [MICROCOMPUTERS AND APPLICATIONS], and it also publishes WEIXINGJI HUIPIAN [MICROCOMPUTER ASSEMBLES] and QUANGUO WEIXINGJI YINGYONGLU [NATIONAL MICROCOMPUTER USER REGISTER].

Instruments and Meters Society--Microcomputer Application Society

This society was established in the Spring of 1981, and its registered affiliation is at the Electronic Engineering Department of the Hefei Industrial University. The society's director is Professor Zhang Diancheng [1728 1156 2052] of this department, the deputy standing secretary is Liang Manjun [733 2581 0689] also of this department. The societies' publication is I/O NEWS YIZONG (DIANNAO YINGYONG JISHU) [I/O NEWS TRANSLATIONS (COMPUTER APPLICATIONS TECHNOLOGY)]. In June of 1984 it will hold its third annual academic meeting in Chengdu.

8226
CSO: 4008/1005

JPBS-CST-85-017
11 June 1985

AUTHOR: LIU Yixin [0491 1837 2500]

ORG: None

TITLE: "The Formula for Random Wind Dispersion of the Unguided Unstable Finned Rocket and the Principle of Zero Wind Dispersion"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 1, Feb 85
pp 11-16

TEXT OF ENGLISH ABSTRACT: In this paper, the formula for random wind dispersion of the unguided unstable finned rocket is derived. Then, using a digital computer, the table of characteristic functions for engineering calculations is given.

In total dispersion, the random wind dispersion of the unguided finned rocket is very important. Therefore, in this paper, the principle of zero wind dispersion is suggested, i.e., in a confined period after the launch of the rocket, the folded fins of the rocket spread out.

AUTHOR: MA Dianrong [7456 3013 2837]

ORG: None

TITLE: "A Method for Calculating the Optimal Fit Ballistic Coefficient"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARII] in Chinese No 1, Feb 85
pp 26-32

TEXT OF ENGLISH ABSTRACT: The problem studied in this paper is how to calculate the optimal fit ballistic coefficient from given coordinates of a trajectory with a constant ballistic coefficient. This is a practical problem in working up firing tables and in other calculations of exterior ballistics. First, the definition of the optimal fit ballistic coefficient and the mathematical description of the problem are pointed out, and the problem is reduced further to an optimization of two variables. Then, the calculation method of the optimal fit ballistic coefficient is narrated and the block diagram of the programming is designed correspondingly. Finally, some examples are recounted in order to show the feasibility of the calculation method mentioned in this paper.

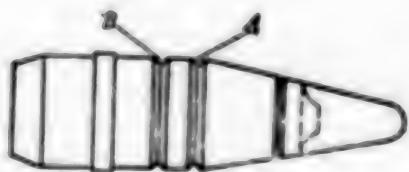
AUTHOR: GAO Juxian [7559 5282 6343]
et al.

ORG: None

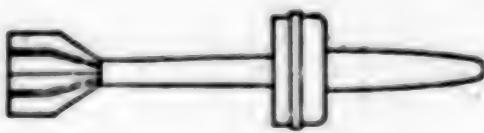
TITLE: "Modeling in the Process of the Perforation of Projectile into a Target"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ARMAMENTARI] in Chinese No 1, Feb 85
pp 33-39

TEXT OF ENGLISH ABSTRACT: This paper discusses a similarity method in the perforation of the projectile into a target. First, various physical quantities and similarity parameters which determine the process of the perforation are analyzed. Then, on the basis of the analysis, the geometrical similarity law is discussed and verified for both the blunt-nose-projectile and the long-rod-projectile.



a) obtuse armor-piercing round



b) subcaliber round

AUTHOR: JIANG Delin [3068 1795 2651]

ORG: None

TITLE: "Synthesis of Nitroderivatives of Hydrazines"

SOURCE: Beijing BINGGONG XUEBAO [ACTA ATMAMENTARII] in Chinese No 1, Feb 85
pp 40-44

TEXT OF ENGLISH ABSTRACT: N-methyl-N, N'-bis(trinitroethyl) hydrazine was prepared by the reaction of methylhydrazine with formaldehyde and nitroform. the nitration of the obtained compound gave N-methyl-N'-nitro-N, N'-bis (trinitroethyl) hydrazine. The structure of the latter was verified by elementary analysis, molecular weight determination, IR and NMR.

The reaction of carbohydrazide and 2,2-dinitro-propenedial-1,3 gave 1,2,4,5-Tetra-7,7-dinitro-bicyclo (3,3,1) nonanone-3. Its structure was also verified.

9717

CSO: 4009/210

Genetics

JPRS-CST-85-017
11 June 1985

AUTHOR: CAO Qunli [2580 5028 4539]
CHEN Fenglin [7115 7685 7673]

ORG: Both of Shanghai First Medical College

TITLE: "A Study of Mutagenicity of Toxaphene in Mice"

SOURCE: Tianjin ZHONGHUA LAODONG WEISHENG ZHIYEBING ZAZHI [CHINESE JOURNAL OF INDUSTRIAL HYGIENE AND OCCUPATIONAL DISEASES] in Chinese No 1, 20 Feb 85
pp 17-19, 63

TEXT OF ENGLISH ABSTRACT: Toxaphene, an organic chloride insecticide, possesses a long residual period. This study is composed of the dominant lethal test, *Salmonella* mutagenicity test (Ames test) and a DNA synthesis inhibition test. The results of the dominant lethal test show no statistical difference in the number of living, dead and resorbed fetuses between the exposed and the negative control groups. However, the rates of encephaloceles in the groups exposed to 3.12 and 50 mg/kg are higher than those of the control groups. The *Salmonella* mutagenicity test shows that the revertants of TA¹⁰⁰ in the non-activated incorporation test exhibit positive results in the 800 mg/plate, and in the above dosage group a dose-response relationship is observed. Toxaphene inhibits DNA synthesis in mice of the 25 mg/kg (1/4 LD 50) group. These results illustrate the potential mutagenicity of toxaphene.

9717
CSO: 4009/202

JPRS-CST-85-017
11 June 1985

AUTHOR: CHEN Ling'ai [7115 3781 1947]
TONG Kezhong [4547 0344 1813]
YU Lei [0060 7191]
ONO Bunichiro

ORG: CHEN, TONG and YU all of the Institute of Genetics, Chinese Academy of Sciences, Beijing; ONO of the Laboratory of Environmental Hygiene Chemistry, Faculty of Pharmaceutical Sciences, Okayama University, Japan

TITLE: "Chromium Resistance in Bacillus subtilis"

SOURCE: Beijing YICHUAN XUEBAO [ACTA GENETICA SINICA] in Chinese No 1, 1985 pp 14-19

TEXT OF ENGLISH ABSTRACT: Several tested strains of Bacillus subtilis were found to be sensitive to CrO₃ at 37.5 µg/ml. Mutants resistant to 100-150 µg CrO₃/ml can be readily generated by UV irradiation of strain 168_{trpC2}⁺. Attempts to transfer chromium resistance to other strains by transformation or transduction have been unsuccessful. Cysteine prototrophs were obtained by transduction and transformation, using cysteine auxotrophic strains as recipients, and chromium resistant mutants or 168_{trpC2} as donors, or by using CysA, CysB or Cys C as donors as well as recipients. It is surprising that all of the Cys⁺ recombinants were resistant to 50 µg CrO₃/ml. Chromium resistance phenocopy can be induced by supplementing the nutrient medium with cysteine. However, this chromium resistance phenocopy was not imposed by L-cysteine alone in the synthetic medium--L-aspartic acid or L-threonine was required for strains containing cysB or cysC, and L-methionine in addition to L-aspartic acid or L-threonine was required for strains containing cysA. Our results indicate that the chromium resistance phenocopy is not the consequence of detoxification of hexavalent chromium by extracellular cysteine.

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TITLE: "Free-electron Laser with Gradient Magnetic Field"

SOURCE: Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese
Vol 12 No 3, 20 Mar 85 pp 129-133

TEXT OF ENGLISH ABSTRACT: In this article, the Lorentz equation and energy equation for the relativistic electrons are solved order by order on the basis of the single-electron model. The gain expression for free-electron lasers with gradient magnetic field is obtained. The results show that when the amplitude of the periodic magnetic field varies along the z direction, the gain is expected to increase.

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TITLE: "Experimental Study of Opto-galvanic Effect in the He-Cd⁺ Hollow Cathode Discharge Tube"

SOURCE: Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol 12 No 3, 20 Mar 85 pp 145-147

TEXT OF ENGLISH ABSTRACT: The opto-galvanic effect in the He-Cd⁺ hollow cathode discharge tube was experimentally studied. The dependence of the opto-galvanic signal (OGS) on the laser power, the discharge current and the position along the laser tube are presented. The possible mechanisms of OGS are discussed. It is found that OGS could be used in measuring the homogeneity and stability of the Cd⁺ concentration along the laser tube.

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TITLE: "Luminescence of Integrated Surface Multi-junction MOM and Its Fast Response to Laser Beam"

SOURCE: Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese
Vol 12 No 3, 20 Mar 85 pp 152-155, 151

TEXT OF ENGLISH ABSTRACT: We have proposed and developed an integrated surface multi-junction MOM (metal-oxide-metal). After being treated by a special electro-forming process, light emission from MOM at room temperature has been observed. The I-V characteristic curve of MOM presents a negative resistance feature at low atmospheric pressure, and a memory effect in air. When multi-junction MOM interacts with a laser or a microwave beam, it shows good performances in producing fast response signals. The device has the potential application of producing electro-magnetic oscillation in the region from microwave to light.

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TITLE: "Generation of High Power CW Tunable Laser Pulse of Nanosecond Duration Using Intracavity Self-injection and Ferrite Transmission Lines"

SOURCE: Shanghai ZHONGGUO JIGUANG (CHINESE JOURNAL OF LASERS) in Chinese Vol 12 No 3, 20 Mar 85 pp 160-164

TEXT OF ENGLISH ABSTRACT: We have systematically analyzed the duration of laser pulse generated by using intracavity self-injection for various cavity arrangements. With the ferrite transmission line technique a driver of high voltage pulse with continuously tunable duration was constructed. A particularly designed avalanche circuit drives the Pockels cell PC_1 to perform both Q-switching and cavity dumping. Only changing the voltage pulse duration, but not the cavity arrangement, a 3 MW single laser pulse output continuously and conveniently tunable from 1.3 nsec to 6 nsec was obtained from a Q-switched phosphate Nd:glass laser.

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TITLE: "Picosecond Ultrahigh Speed Photography Using Grating as Sampler"

SOURCE: Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese
Vol 12 No 3, 20 Mar 85 pp 169-172

TEXT OF ENGLISH ABSTRACT: The grating sampling method has been successfully used in ultrahigh speed photographic experiments. Since the method has the advantage of efficient and continuous sampling, ultrahigh speed photography is expected to have practical application as a picosecond oscilloscope.

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TITLE: "The Fast Preconcentration of Uranium from Seawater and Its Determination"

SOURCE: Beijing HAIYANG KEXUE [JOURNAL OF MARINE SCIENCE] in Chinese
No 1, 9 Jan 85 pp 29-31

TEXT OF ENGLISH ABSTRACT: Test results show the optimum pH conditions of the carrier coprecipitation is 7.0, the concentration of aluminum sulphate is 3.34 g/L, the clam shell powder is 7 g/L, the solution temperature is 19°C, and the agitation time after coprecipitation is five minutes.

The concentration of uranium from near-shore seawater of Qingdao is determined to be 2.75 μ g/L on the average.

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JPRS-CST-85-017
11 June 1985

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TITLE: "Synthesis of Cyclopentylpropionic Ester of Norethisterone Acetate as Long-acting Contraceptive"

SOURCE: Beijing YAOXUE XUEBAO [ACTA PHARMACEUTICA SINICA] in Chinese No 12, 29 Dec 84 pp 935-937

TEXT OF ENGLISH ABSTRACT: In order to prolong the biological action of norethisterone acetate (I) we have synthesized its cyclopentylpropionic ester (IV). I was reduced to its hydroxy intermediate (II) by potassium borohydride in 91 percent yield and then esterified with cyclopentyl chloride to give IV in 49 percent yield.

A single intramuscular dose of 60 mg of cyclopentylpropionic ester of norethisterone acetate was found to protect women from pregnancy for three months. The efficacy rate of the contraceptive effect in 1728 cases of clinical trials was about 99.6 percent.

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TITLE: "Basic Study of Spatial Filter Used in Nd-Glass High Power Laser System"

SOURCE: Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 34 No 2, Feb 85 pp 171-181

TEXT OF ENGLISH ABSTRACT: In this paper, image relaying of the spatial filters on the high power Nd-Glass laser system for improving brightness of laser beam is demonstrated. Detailed theoretical treatment and numerical calculation of selection of filtering pinholes are carried out. Finally, a new idea about the depth of the field of the spatial filter and several new experimental methods for adjusting spatial filters are suggested.

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TITLE: "Stimulated Brillouin Sidescattering in Laser-irradiated Plasmas"

SOURCE: Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 34 No 2, Feb 85 pp 188-195

TEXT OF ENGLISH ABSTRACT: The stimulated Brillouin scattering process under the interaction of high intensity sub-ns pulse laser with plasmas has been investigated, with a larger extent of underdense plasma being produced in advance. The occurrence of instability of both stimulated Brillouin backscattering and sidescattering can be confirmed simultaneously through careful measurements of the energy and spectrum of the backscattered light, as well as the angular distribution of the sidescattered light, especially its space anisotropy.

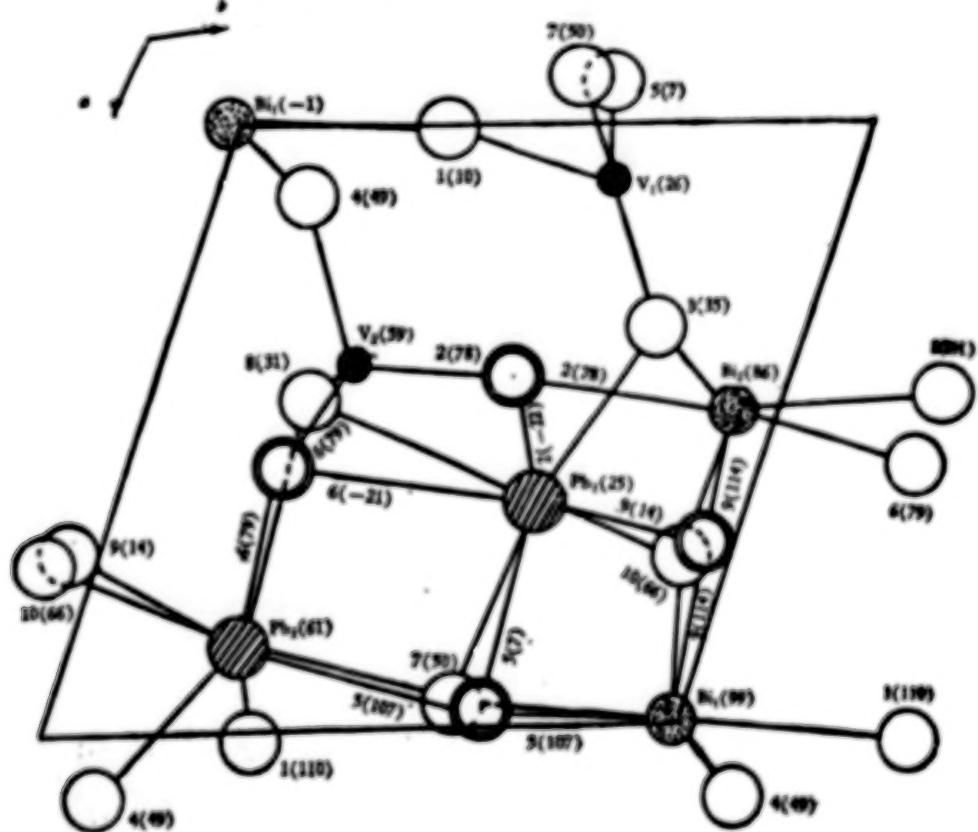
AUTHOR: WANG Peiling [3769 0160 3781]
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TITLE: "The Crystal Structure of $\text{Bi}_2\text{Pb}_2\text{V}_2\text{O}_{10}$ "

SOURCE: Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 34 No 2, Feb 85 pp 235-240

TEXT OF ENGLISH ABSTRACT: The crystal structure of $\text{Bi}_2\text{Pb}_2\text{V}_2\text{O}_{10}$ has been determined by X-ray single crystal diffraction method. The crystal belongs to triclinic system with space group $\text{P}1$, $Z=1$ and cell parameters: $a=7.084(4)\text{\AA}$, $b=7.278(3)\text{\AA}$, $c=5.587(3)\text{\AA}$, $\alpha=111.91(5)^\circ$, $\beta=95.01(6)^\circ$, $\gamma=108.86(4)^\circ$, $V=245.70\text{\AA}^3$, $D_x=7.35\text{ g/cm}$, $(\text{MoK}_\alpha)=678.94\text{ cm}^{-1}$, $F(000)=456$. The structure was analyzed by means of Patterson function and Fourier techniques. The coordinates of atoms, isotropic and anisotropic thermal parameters were refined to $R=0.079$ for 1054 independent reflections by the least-squares refinement procedure. The structure analysis shows that eight O atoms around a Pb atom form a polyhedron with eight vertexes and six O atoms around a Bi atom form a polyhedron with six vertexes. Two Pb-O polyhedra with a common edge connect with two Bi-O polyhedra with a common edge. They extend along the bc plane. The effect of absorption is discussed. Finally, a comparison of the structure of $\text{Bi}_2\text{Pb}_2\text{V}_2\text{O}_{10}$ with Pb_2SO_3 is made.



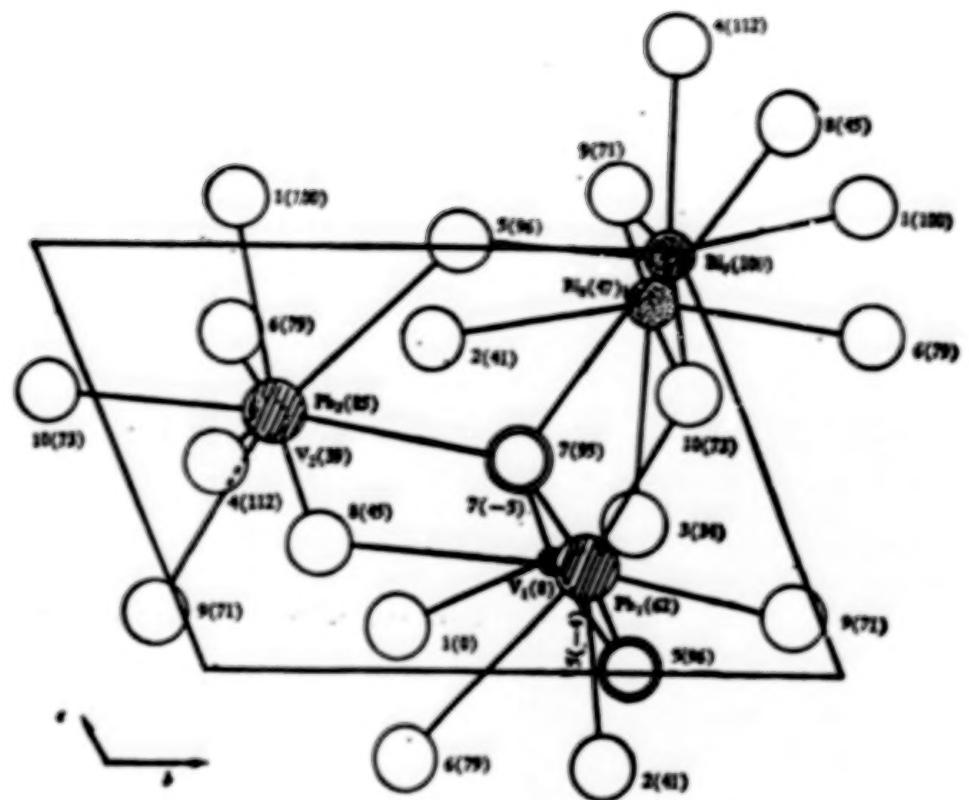


Figure 2. Projection of $\text{Bi}_2\text{Pb}_2\text{V}_2\text{O}_{10}$ structure in direction a

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TITLE: ⁷Li NMR Studies of Ionic Conductor in the Solid Solutions
Li₃VO₄-Li₄TO₄ (T=Ge, Si)"

SOURCE: Beijing WULI XUEBAO [ACTA PHYSICA SINICA] in Chinese Vol 34 No 2,
Feb 85 pp 263-268

TEXT OF ENGLISH ABSTRACT: The ⁷Li NMR spectra of the solid solutions between Li₃VO₄ and Li₄TO₄ (T=Ge, Si) with different compositions were investigated in the range of 150-573 K. It was found that the values of ⁷Li NMR linewidth and spin-lattice relaxation time T₁ in γ_{II} phase solid solutions are about an order of magnitude less than those of Li₄GeO₄, Li₄SiO₄ and Li₃VO₄ at room temperature. The temperature dependence of the number and the intensity ratio of ⁷Li NMR quadrupole satellite lines, and the composition dependence of the former were observed. It is suggested that the Li⁺ ions in samples of γ_{II} structural compositions probably move about one order of magnitude faster than those of the three pure compounds. The number of inequivalent sites occupied by the Li⁺ ions changes with the composition. The occupancy of the Li⁺ ions in the inequivalent sites changes with the temperature.

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